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Dessert banana

pacific food leaflet n° 1

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Bananas (*Musa* spp.) are a great food for people of all ages. They can be eaten as a snack or dessert. They are convenient, tasty, hygienic and available everywhere. Bananas are covered by an easy-to-remove skin that keeps in the nutrients and keeps out germs that can cause illness. They are also easily grown and harvested.

The soft texture of ripe bananas makes them an excellent food for young children (from around six months of age). 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; for example, mixed with flour to make breads or pancakes.

Imported snack foods are sold in many shops. These highly processed products are often used for snacks and small meals, but most of them contain unhealthy amounts of salt, sugar and fat and have much lower food value than fresh ripe bananas.

Varieties of dessert bananas

All bananas can be eaten raw or cooked but some are preferred as 'eating bananas' and are consumed uncooked when ripe. Banana specialists call them 'dessert bananas' meaning they are eaten after the main part of the meal. There are also 'cooking bananas'. Pacific farmers still grow many different types of bananas with a great variety of shapes, sizes, and peel and flesh colors.

Some types of banana weigh only 30 grams, whereas some large dessert bananas weigh up to 300 grams. The peel color is often bright yellow but may also be red or orange.

Bananas also vary greatly in taste and texture. Some are much sweeter than others. Some have a very creamy texture and can be eaten with a spoon.

Unfortunately, some banana varieties are disappearing from Pacific farms because of alternative land uses,

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cultural changes and neglect. However, Pacific countries are working with regional and international programmes to try to save these varieties by conserving them in collections and promoting their use.

Plant growth structure

Banana plants grow from an underground stem called a corm. The corm sends up a shoot called a sucker. This grows into a mother plant that dies after it fruits. The trunk of the banana plant is mostly rolled leaf bases. Bananas are usually propagated by planting out suckers.

Different varieties of bananas have differences in plant structure. Some are short and some are tall (3 to 8 metres or 8 to 15 feet). For most varieties, the growing bunches of bananas droop down, but Fe'i bananas, which are unique to the Pacific, have bunches that grow upwards and purple sap. (The whole set of fruit is called a 'bunch', a cluster of fruit a 'hand' and a single fruit a 'finger'.) There are also differences in the leaves of banana varieties.

Banana plants grow well throughout the Pacific. However some, such as Fe'i bananas, grow best in rich soils and moderate shade and do not grow well on the dry sandy soils of atolls.

Harvesting

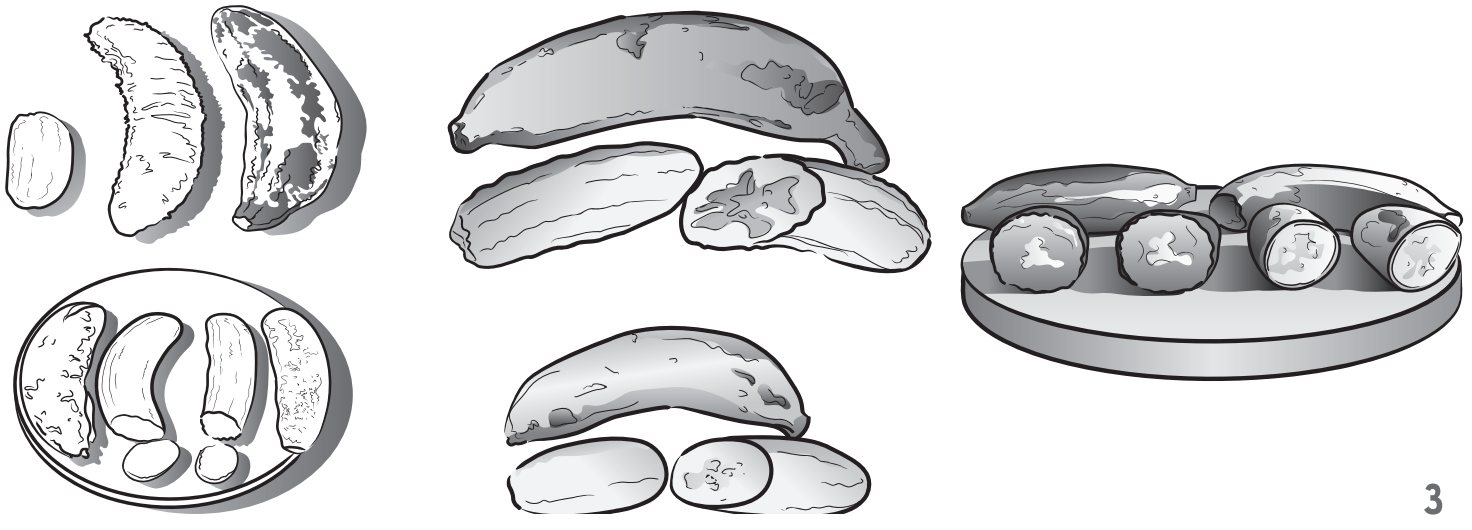
Banana plants fruit after one to one and a half years depending on the variety and growing conditions. They fruit throughout the year but are more likely to fruit during warmer weather.

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. Ripe bananas give off ethylene gas, which promotes ripening. Thus, various methods are used to ripen them more quickly, such as placing green fruit in bags with ripe bananas.

Nutrition

Bananas are rich in the energy that the body needs for warmth, work and play. Sportsmen and sportswomen use them to quickly boost their energy during exercise. The energy comes from the fruit sugar and starch in the bananas. Green bananas have higher levels of starch. As bananas ripen, the starch turns to sugar. 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.

The nutrient content of different varieties of dessert bananas varies greatly. Banana varieties 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. Cooking does not destroy carotenoids and may even help the body use them more effectively. Consuming carotenoid-rich food may help to protect against diabetes, heart disease and cancer.

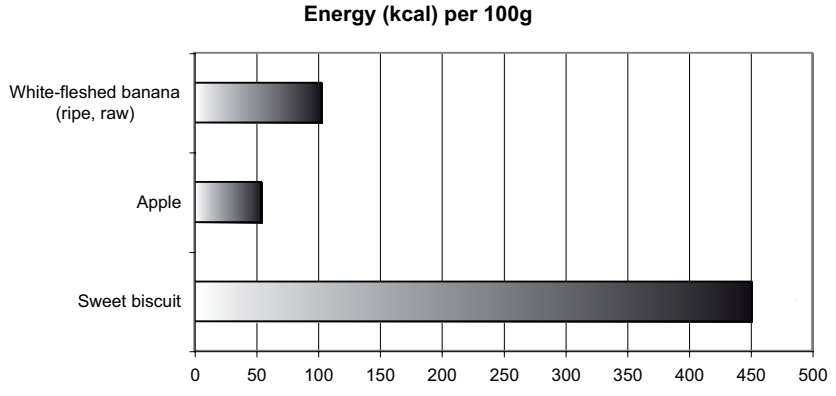


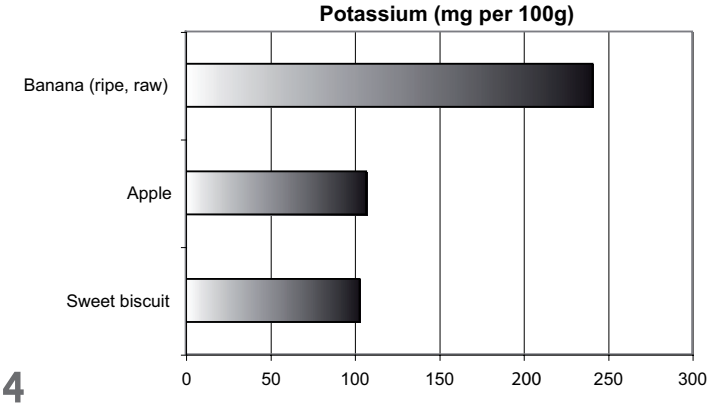
Dessert banana

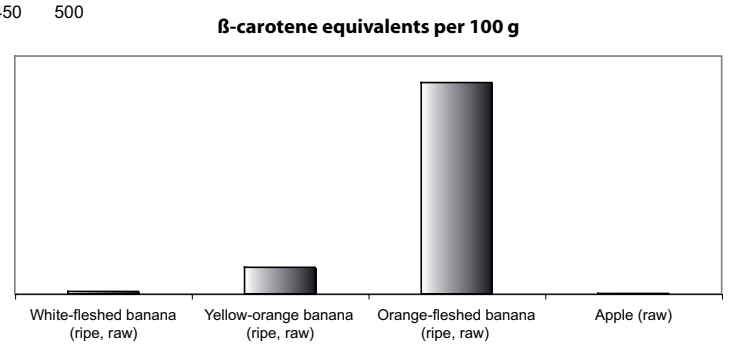
Comparison of the nutrient content of 100 gram (g) edible portions of banana, sweet biscuit and apple.

	Kcal*	Fibre (g)	Calcium (mg)	Potassium (mg)	ß-carotene equivalents** (µg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)	Vitamin E (mg)
Ripe banana common varieties (white-fleshed, raw[1])	100	0.8	11	241	46	0.08	0.7	17.3	0.4
Ripe banana, cream-fleshed, raw/cooked[2]	na	na	na	na	85-205	na	na	na	na
Ripe banana, yellow-fleshed, raw/cooked[2,3]	na	na	6.5	269	232-892	na	na	na	na
Ripe banana, yellow/orange-fleshed, raw/cooked [2-4]	na	na	68.6	253	565-2473	0.47-14.30	22.6	na	1.55
Ripe banana, orange-fleshed,raw/cooked [2-4]	na	na	na	na	1450-8508	1.76	na	na	na
Sweet biscuit[1]	451	2.0	31	103	6	0.02	1.6	0	0.3
Apple[1]	54	2.0	5	107	10	0.01	0.1	5	0.4

[1]Dignan et al. 2004; [2]Englberger et al. 2003a; [3]Englberger et al. 2005b; [4]Englberger et al. 2005; na= not available.
*Energy expressed as kilocalories. **This unit is the sum of beta-carotene and one-half the sum of other provitamin A carotenoids.
Note: weights of bananas vary. A white-, cream- or yellow-fleshed banana weighs ~50–150 g. The yellow/orange-fleshed *Karat* Fe'i banana weighs ~100–300 g. The orange-fleshed *Utin Iap* Fe'i banana weighs ~50–70 g. A sweet biscuit weighs ~7 g. An apple weighs ~130 g.







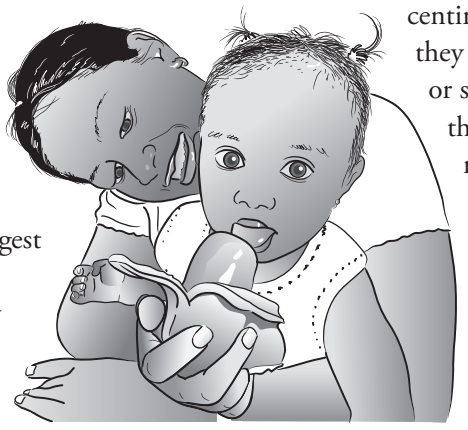
One type of Fe'i banana (called *Karat* in Pohnpei) is very rich in riboflavin (see table). When someone eats one of these bananas, their urine may become very yellow, probably due to the rich riboflavin content. This is a harmless side-effect. One *Karat* provides more than the estimated daily requirements for an adult or child. *Karat* bananas are also rich in niacin (a B vitamin), alpha-tocopherol (vitamin E) and calcium. Bananas are a good source of vitamin C, which is important for fighting against infection and helping the body to use iron. The banana bud is also rich in Vitamin C and provitamin A carotenoids.

In addition to carotenoids and vitamins, bananas are rich in vital minerals, such as potassium, which is important for regulating our metabolism and maintaining normal blood pressure. Bananas contain many of the nutrients lost during diarrhoea, so they are a good food for people to eat at this time.

The bar graphs show the nutrient content of a white-fleshed banana compared to an apple or sweet biscuit. Bananas are clearly a better choice because they have much higher food value.

Infant food

Ripe bananas are an excellent first food for infants. (Infants should be given only breast milk for the first six months, but after this other foods should be given.) They are very easy to digest and making infant food at home with locally grown bananas is easy and saves money. Infants can be fed either raw, mashed ripe banana, or the ripe banana can be cooked.



In some countries, there are fears that certain banana varieties should not be fed to children because they 'cause worms'. This is not true. Bananas are very safe as long as the peel is still intact before they are used; they rarely cause any problems. However, good hygiene must always be observed: check that the peel is not broken, store the bananas in a pest-free environment, and wash the hands before preparing food and feeding infants.

Using dessert bananas

Dessert bananas can be used in many ways:

- Eaten fresh and raw as a snack or dessert
- Boiled, steamed, baked, or 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 infant food
- Dried in slices for snacks

Other parts of dessert banana plants can also be used:

- Banana leaves can be used for wrapping and food presentation
- Banana flowers can be prepared for eating
- The stem and fibre can be used for medicinal purposes

Dried bananas

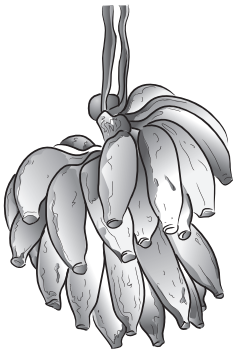
1. Choose firm, ripe bananas of any kind. Ripe cooking bananas can also be used. Avoid overripe bananas as they do not dry well.
2. Peel bananas and cut into slices about1 centimetre thick. If the slices are too thin, they fall apart during the drying process or stick to the drying tray. If they are too thick, they do not dry properly in the middle. All the slices should be about the same thickness so they dry in the same time. The slices can be tossed in lime/lemon juice at this stage to minimize the browning (oxidation) shown by some varieties (such as *Cavendish*) during the drying process.
3. Dry the banana slices on trays either in the sun, in an oven, or in 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.

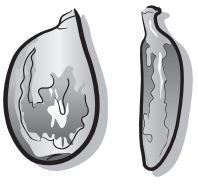
Dried bananas make a delicious inexpensive snack and are convenient for carrying. Selling dried bananas is a good way to make money using a local food. Dried bananas can also be soaked and added to dishes such as porridge before cooking.

Taiwang (Pisang kelat) banana pancake

- 3 cups flour
- 3 teaspoons baking powder
- 2 cups water, or as needed
- 1–2 cups ripe Taiwang banana (4–8 bananas)
- Oil for frying

1. Mix flour and baking powder.
2. Add water to the flour mixture and mix into a soft dough (slightly more or less water may be needed).
3. Mash banana and mix into the flour and water mixture.
4. Coat the frying pan with enough oil for lightly frying, or use a non-stick pan.
5. Add a few spoonfuls of batter and fry, one side at a time.
   Note: the *Taiwang* banana is a very sweet banana when ripe. No added sugar is needed. Other dessert bananas can be used, although it is good to use bananas with deep yellow or orange flesh for their rich nutrient content.





Three banana fruit salad

- 2 ripe yellow/orange-bananas, such as Karat, or 5 orange-fleshed bananas, such as Utin Iap
- 10 ripe yellow-fleshed bananas, such as Taiwang or Sucrier
- 10 white-fleshed bananas, such as Lady Finger
- ¼ cup fresh citrus juice, such as kalamansi or lime

1. Select three banana varieties with different coloured flesh, for example, yellow, orange and white.
2. Peel and cut fingers into bite-size pieces or slices. Put in a bowl, add juice and mix.
3. Leave to marinate for a few hours or even overnight in the refrigerator before serving.
   Note: orange- and yellow-fleshed bananas are rich in provitamin A carotenoids and protect against diabetes, heart disease, cancer, vitamin A deficiency and anemia. All bananas are rich in vitamin C, which is important for good health.

Banana rice

Six to eight servings:

- 2 cups rice (uncooked)
- 12 ripe bananas
- 1 coconut

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

Giant swamp taro with banana

(Rodima wus, recipe from Mwaoakilloa. Pohnpei, FSM)

- 3 cups giant swamp taro (about 2 medium-sized giant swamp taro)
- 3 cups ripe banana
- 2 cups coconut juice (about 2 coconuts)

1. Peel and grind raw taro. If possible, use yellow-fleshed varieties with high carotenoid content.
2. Peel and pound ripe banana until well mashed.
3. Add coconut juice to taro and banana and mix well.
4. Put the mixture into a baking tin and bake for about 1 hour.
5. Serve.

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Cooking banana

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Cooking bananas are an important staple food for many people in the Pacific. Most types of banana (*Musa* spp.) can be harvested and cooked when still green, but some varieties are more commonly used for cooking. In this leaflet, these are referred to as 'cooking bananas'.

Cooking bananas are generally eaten when still green and starchy. However, some are also eaten in the half-ripe and ripe stages, in which case they are considered both 'cooking' and 'dessert' types.

Different types of cooking bananas

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 bananas have small fruit 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 and plantains is generally a deeper colour, ranging from cream to orange, although the white-fleshed *Cavendish* variety is also used for cooking in some places.

Plant growth and structure

Banana plants grow from an underground stem called a corm that sends up a shoot called a sucker. This grows into a mother plant that dies after it fruits.

The plants are propagated by suckers and usually fruit after one to one and a half years. They fruit throughout the year but are more likely to fruit during warm weather. The whole set of fruit is called a 'bunch', a cluster of fruit a 'hand' and a single fruit a 'finger'.

There are many differences in the plant structure of various types of cooking bananas. Some grow to only 3 metres (8 feet) high, while others grow as high as 8 metres (15 feet). The bunches of fruit hang downwards except for Fe'i bananas, which grow upwards. Fe'i bananas are unique to the Pacific.

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Nutrition

Cooking bananas are rich in the energy (calories) 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.

Vitamin A

- Cooking bananas with yellow or orange flesh are rich in provitamin A carotenoids, the precursors to vitamin A.
- As bananas ripen, the flesh colour changes and the provitamin A carotenoids gradually develop to their maximum levels.
- Carotenoids are not usually destroyed during cooking. In fact, cooking may help the body use them more easily.
- Some varieties have deeper yellow or orange flesh. When ripe, they may contain up to 400 times more beta-carotene than white-fleshed varieties.

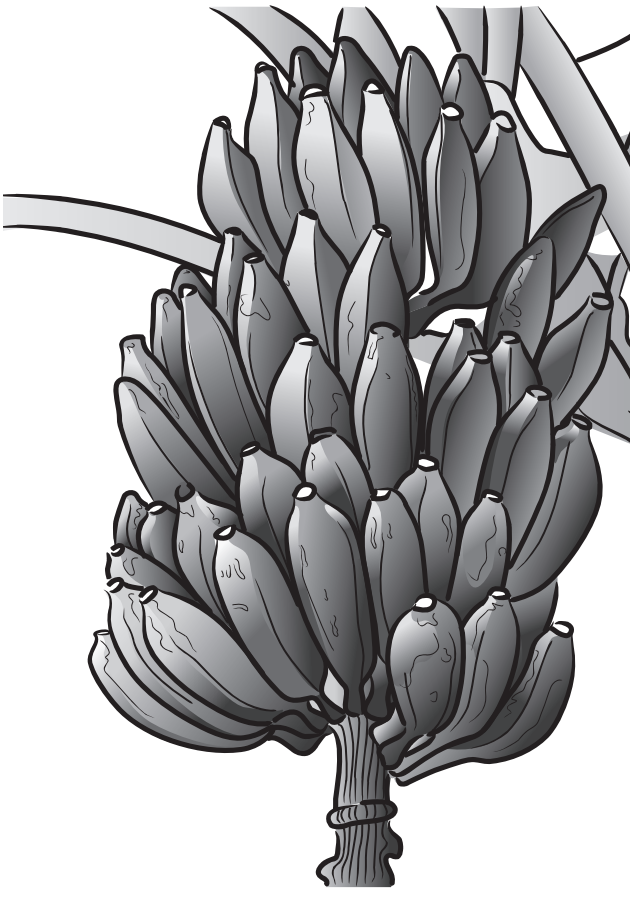
Vitamin A is important for protecting against infection and for good vision and healthy eyes. Beta-carotene is the most important of the provitamin A carotenoids. Consuming carotenoid-rich food may help to protect against diabetes, heart disease and cancer.

Other nutrients

Research shows that a variety of Fe'i banana called *Karat* has high levels of riboflavin (a B vitamin), niacin (another B vitamin), alpha-tocopherol (vitamin E) and the mineral calcium, which is vital for bones and teeth.

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.

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.

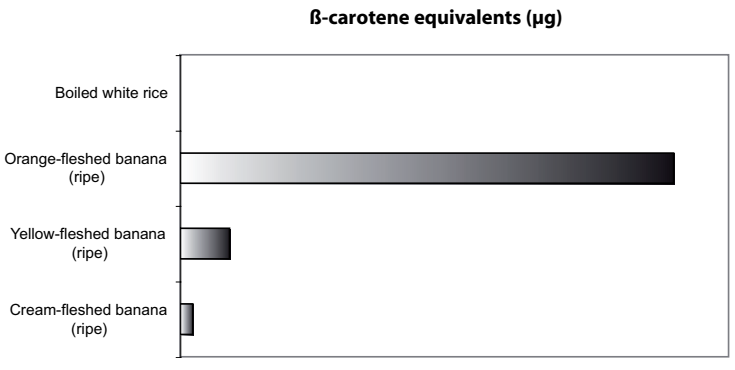


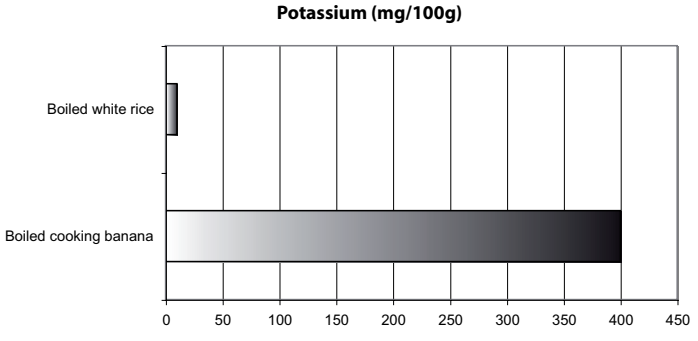
The table and graphs below compare the nutrient content of fresh banana products to boiled white rice, which is often used to replace local starchy foods. Bananas are a better choice because they have higher food value.

Comparison of nutrient content of 100 gram (g) edible portions of banana and white rice

	Kcal*	Fibre (g)	Calcium (mg)	Iron (mg)	Potassium (mg)	Beta-carotene equivalents* (µg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)	Vitamin E (mg)
Cooking banana, boiled, flesh colour and maturity not specified[1]	111	1.2	5	0.5	400	116	0.04	0.5	9.0	0.3
Ripe cooking banana, fried, flesh colour not specified[1]	265	2.3	6	0.8	610	149	0.02	0.6	12.0	2.2
Ripe banana, boiled, cream-flesh, raw/cooked[2,3]	na	na	na	na	na	85–205	na	na	na	na
Ripe banana, boiled, yellow-flesh, raw/cooked[2,3]	na	na	6.5	0.1	269	232–892	na	na	na	na
Ripe banana, yellow/orange-flesh, raw/cooked [2,3]	na	na	68.6	0.2	253	565–2473	0.47–14.30	22.6	na	1.55
Ripe banana, orange-flesh, raw/cooked [2,3]	na	na	na	na	na	1450–8508	0.2	na	na	na
Banana flower, cooked[1]	42	1.8	70	2.0	572	184	0.02	0.7	3.0	trace
Banana flower, raw[1]	43	1.5	73	2.1	601	193	0.03	1.1	5.8	trace
White rice, boiled[1]	123	0.8	4	0.3	10	0	0.01	0.6	0	trace

[1] Dignan et al. 2004; [2] Englberger et al. 2003a; [3] Englberger et al. 2005b; na = not available.
*Energy expressed as kilocalories; †provitamin A carotenoids expressed as the sum of the ß-carotene plus half of the ß-carotene.
Note: A white-fleshed banana weighs 50–150 g, a *Karat* banana weighs 100–300 g, and an *Utin Iap* banana weighs 50–70 g.





Using cooking bananas

Cooking bananas can be used in many ways:

- 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

Banana flower buds are picked from the ends of bunches of cooking bananas when the fruit is half grown. Picking the flower buds at this stage 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, kneading to wash out some of the sticky sap. Rinse in fresh water and use in salads, soups or other cooked dishes, including meat-less burgers and seafood or meat dishes.

Banana leaves are not eaten but are often used to wrap food. Use a clean, undamaged, whole green banana leaf and soften it by holding it over a flame. Cut the mid-rib off the back so that the leaf lies flat. Then cut the leaf to the size needed. After filling it with food, fold and tie with a mid rib from a coconut leaf. 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 food is to wrap packets of food in banana leaves and steam or bake the packets in an earth oven.

Preparation and preservation

For easy peeling, green bananas are boiled or steamed in their skins until soft and then peeled. Traditionally, green bananas are cooked in earth ovens or over hot coals. They may be peeled, soaked in salty 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.

Dried bananas

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

1. Firm, ripe bananas of any kind can be dried, although some varieties dry better than others. Ripe cooking bananas dry very well, but do not use overripe ones.
2. Cut the peeled bananas into slices about 1 centimetre thick. If the slices are too thin, they will break up when drying or stick to the drying tray. If they are too thick, they will not dry thoroughly. All the slices should be about the same thickness. The slices can be tossed in lime or lemon juice at this stage to minimise the browning (oxidation) that some varieties show during the drying process.
3. Dry the banana slices on trays either in the sun, in an oven at a very low temperature, or in a dehydrator. Be sure to cover the slices well during drying to protect against flies and other pests.
4. Store the dried slices in airtight containers or sealed plastic bags.

Infant food

After being breastfed for 6 months, infants can be given ripe cooking banana in addition to breast milk. It is better to give them bananas with deeper yellow or orange flesh as these have higher food value than the white-fleshed types.

Recipes

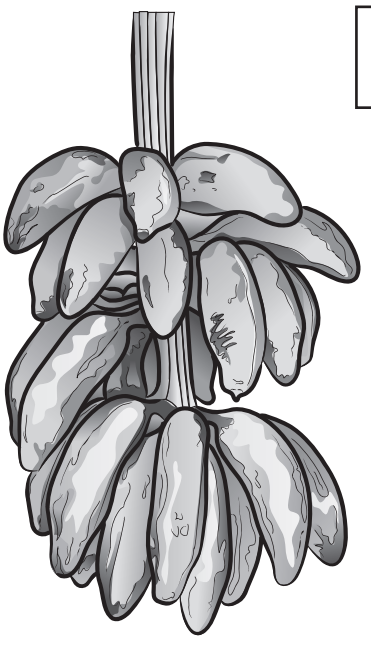
Banana flower bud soup

Four servings:

- 2 cooking banana flower bud
- 1 cup shelled shrimp or prawns
- 1 onion, sliced
- 4 tablespoons oil
- 2 cups water
- 4 cloves garlic, chopped (optional)
- lemon juice

1. Remove the tough outer covering of the flower bud until the tender parts are reached. Slice into thin pieces. Wash the pieces in salty water, squeezing out the sap, and rinse. Set aside to cook later.
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 chopped banana flower buds. Turn over constantly until tender.

Note: Banana flowers can also be prepared as a vegetable; simply leave out the shellfish.



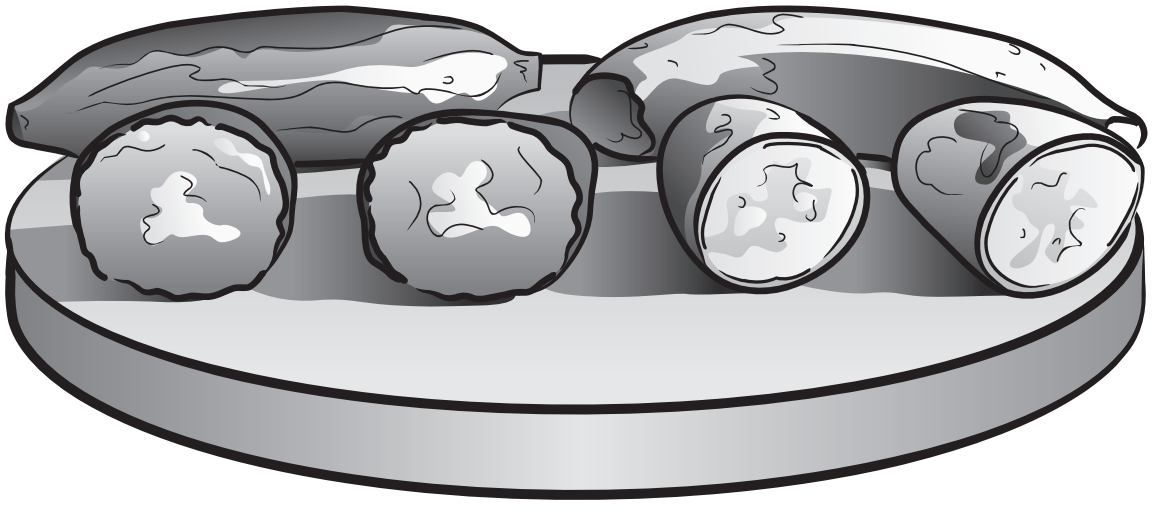
Baked cooking banana and fish

Eight servings:

- 4 ripe cooking bananas
- 8 pieces of fish
- 1 onion, sliced
- 4 tomatoes, sliced (optional)
- Coconut cream from 2 coconuts – about 1 cup
- Clean banana leaves

1. Peel bananas and slice.
2. Divide the bananas, fish and other ingredients on to eight pieces of banana leaf and wrap into packages.
3. Place the packages in a baking dish.
4. Bake in oven at a moderate temperature (180°C or 350°F) until the fish is tender (about 30–45 minutes).

For health reasons, it is best not to add salt.



Stuffed banana and fish

Six to eight servings:

- 6 green cooking bananas
- 225 g (8 oz) fresh or canned tuna
- 1 onion, chopped
- 1 egg, beaten

1. Without peeling the bananas, cut them into halves lengthways.
2. Scoop out the flesh with a spoon, leaving a boat-shaped peel.
3. Grate the banana flesh.
4. Mix the fish and chopped onion with the grated banana. Add the beaten egg to bind the mixture.
5. Put the mixture back into the banana peels. Tie the halves together with string.
6. Steam for 25 minutes or bake in oven at a moderate temperature (180°C or 350°F) for 45 minutes.

Baked grated bananas

- 25 green bananas
- 4 coconuts, grated

1. Scrape out three-quarters of the flesh of the green bananas with a spoon, scraping in a lengthwise direction.
2. Put the scraped-out banana back into the banana peel.
3. Place the bananas in a pot, stacking them one on top of the other.
4. Squeeze in enough coconut cream to just cover the bananas.
5. Boil until cooked.

Note: Some people add sugar to this dish. For health reasons, it is best not to add sugar. If you do, add only a very small amount.

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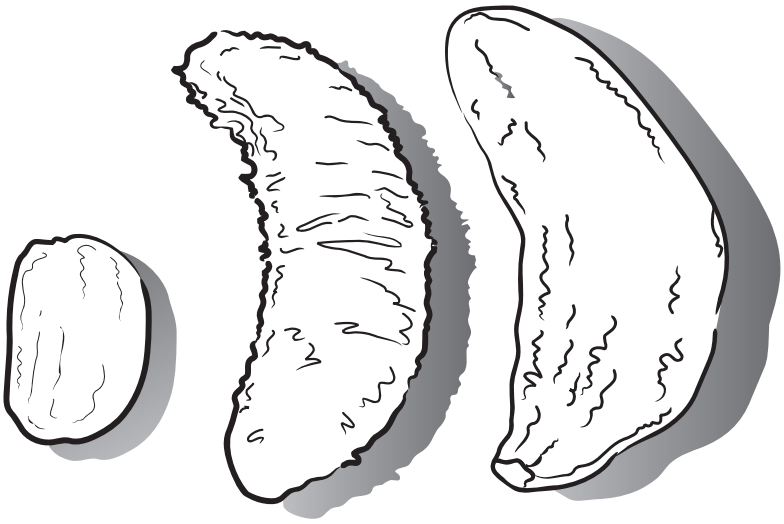

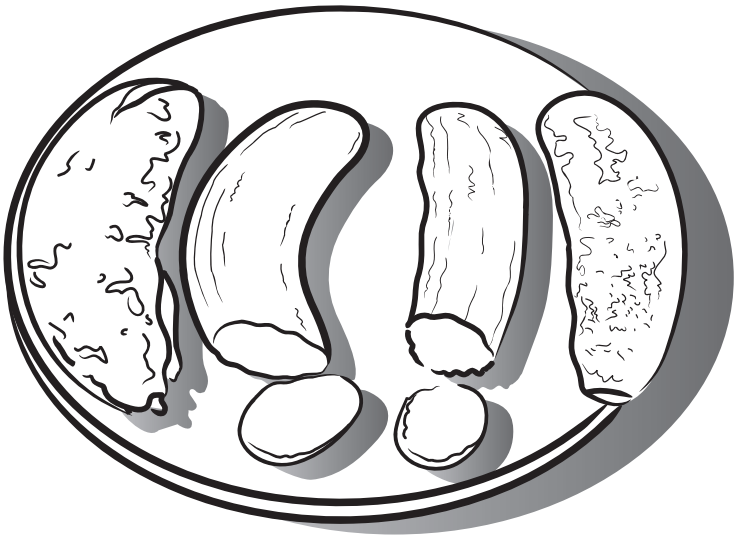

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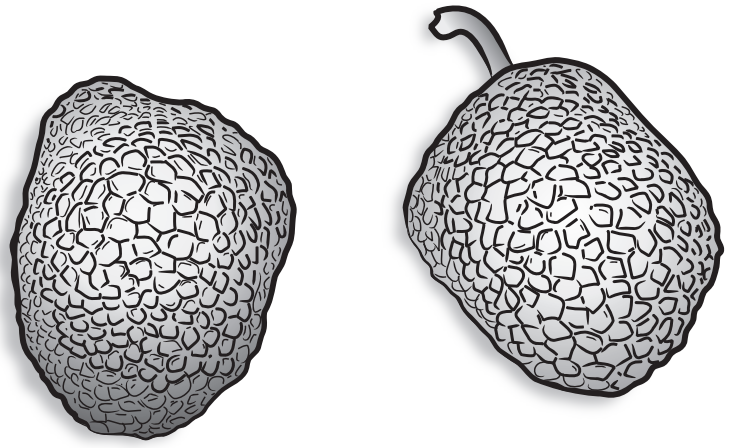
Breadfruit

pacific food leaflet n° 3

ISSN 1018-0966



The fruit of the breadfruit tree is an important staple food in the Pacific. As with all foods, it should be remembered that "Fresh is best". However, breadfruit is a seasonal crop and sometimes the crop is so plentiful that it cannot all be eaten fresh. To prevent waste, various methods of preserving breadfruit have been developed. Before Europeans came to the Pacific and introduced their foods, breadfruit was preserved in many different ways including fermenting and drying. In some parts of the Pacific, it is still preserved using these old methods.

Unfortunately, a lot of breadfruit is now wasted because of neglect and because few people remember how to preserve it. It is possible to preserve larger quantities of breadfruit by adapting the old fermenting and drying methods, or by using new methods such as freezing. Flour made from breadfruit can be combined with wheat flour to make bread.

Combining old and new ways of preparation and preservation could make breadfruit an important food for all seasons. When people make good use of breadfruit, they do not have to buy as many imported foods. Eating breadfruit also improves the diet and may help lower the risk of serious health problems including diabetes, heart disease and cancer.

Varieties of breadfruit

Throughout the Pacific Islands there are both seedless and seeded types of breadfruit (*Artocarpus altilis*). In Micronesia, there is a related species with seeds *(Artocarpus mariannensis*). There are also some variations within these breadfruit types and hybrids.

Seeded breadfruit is a delicacy on many islands. It can be eaten raw as a fruit for a snack or dessert, or cooked as a staple food and eaten as part of the main meal. The seeds, which are eaten cooked, have a pleasant texture and taste. There are many other differences between varieties of breadfruit; for example, the leaves have different

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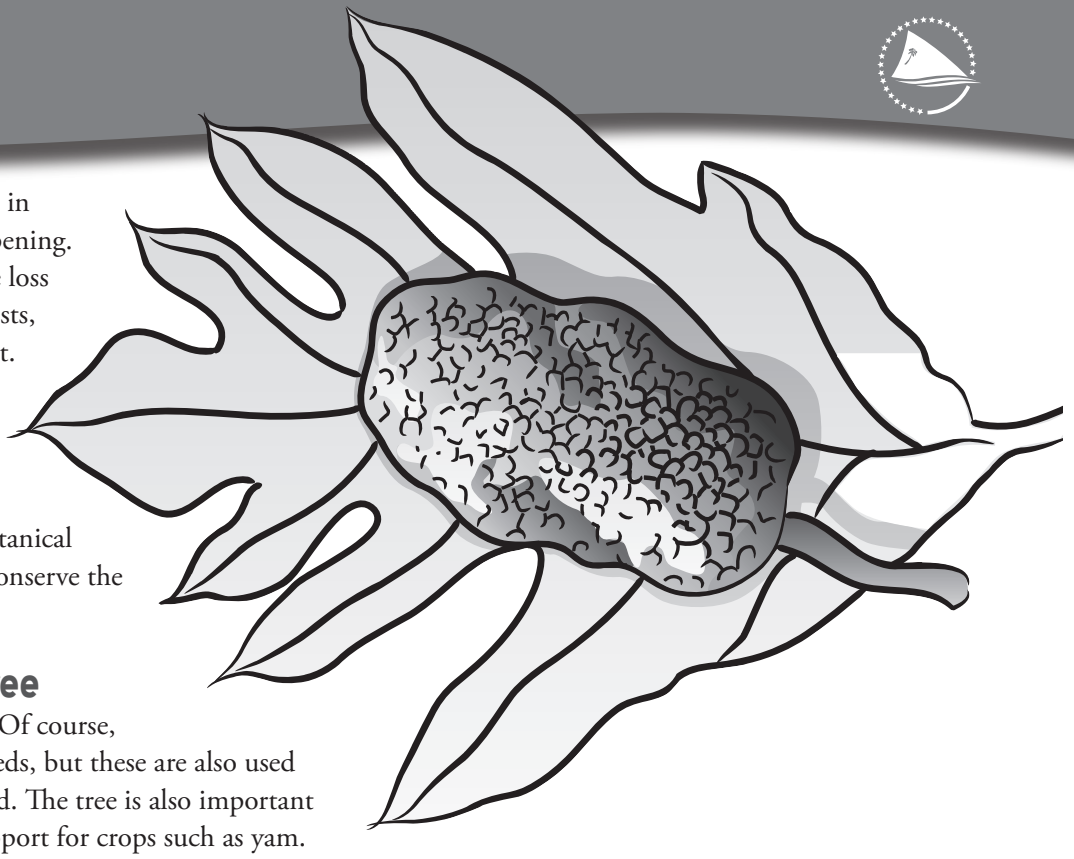


shapes and the fruits differ in shape, size, and time of ripening. There is concern about the loss of some varieties due to pests, disease, old age and neglect. Collections have been started, for example, at the Breadfruit Institute (http://www.breadfruit.org), National Tropical Botanical Garden, Hawaii, to help conserve the many varieties.

A multi-purpose tree

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, or 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.

Growing breadfruit

Breadfruit trees grow from 9 to 18 metres (30 to 60 ft) tall. They generally begin bearing fruit after about three years and continue to bear fruit for over 50 years. The trees may be planted by taking young shoots or root suckers that come up around older trees. Young breadfruit trees need protection from hot sun and general management and weed control. Later they need sunshine and grow best in full sunlight.

Breadfruit generally grows well with little care. However, trimming off old branches and diseased leaves is important. Pruning taller branches and cutting off the top also gives trees a better chance of surviving wind storms and cyclones and makes fruit picking easier. Good management, such as cutting away surrounding grass and plants and planting several different breadfruit varieties, will ensure good growth and protect against diseases. On atolls, breadfruit trees are often cared for by adding compost to the soil and watering them sometimes.

Harvesting and ripening

Breadfruit is usually picked when mature but not yet ripe, which may be about one month after the fruit forms. People traditionally use a pole to harvest the fruit. Men and children also climb the trees to pick the fruit, using ropes if the trees are tall. It is best to pick breadfruit from the tree rather than letting it drop to the ground. The fruit gets damaged when it hits the ground and softens sooner than fruit that is handpicked or caught as it falls.

Breadfruit may be eaten at different stages of maturity. Most commonly, it is eaten at the mature green (hard) stage and mature ripe (soft) stage. Half-ripe and ripe breadfruits are specialties in some regions. Breadfruit can be ripened by piercing the core and inserting either salt water, the rotting petiole of *Alocasia* taro, or already ripened breadfruit. It can also be ripened by wrapping it in old cloths and covering it with leaves overnight or for a few days.

Nutrient content

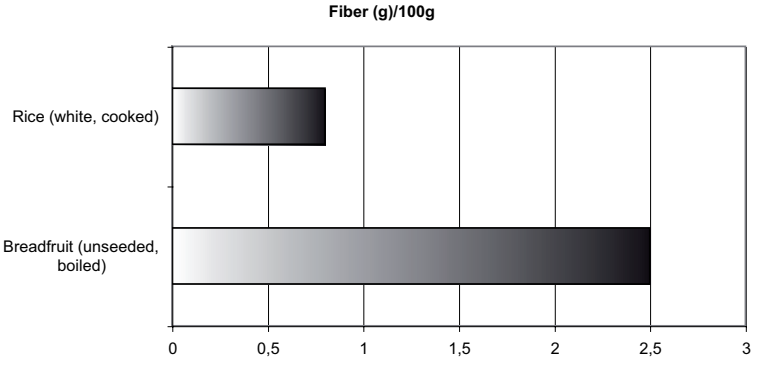
Breadfruit is an important energy food that contains starch and sugar. The levels of these vary according to the stage of ripeness at which the fruit is eaten (see the table). The amount of provitamin A carotenoids, the precursors to vitamin A, also varies with ripeness.

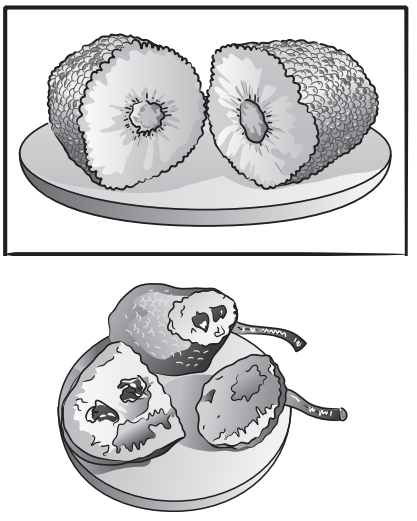
Comparison of nutrient content of 100 gram (g) edible portions of breadfruit and white rice.

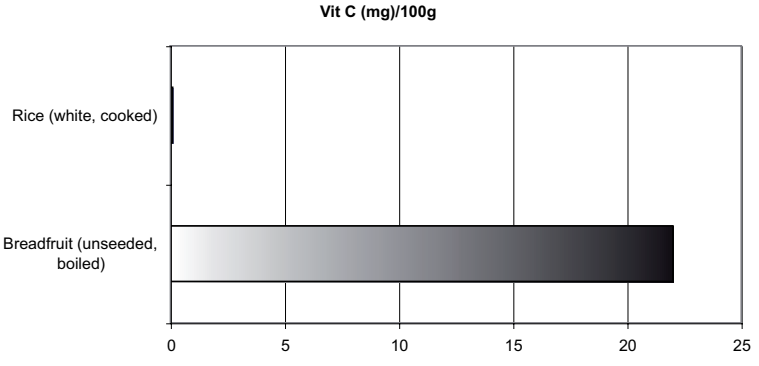
	Kcal*	Fibre (g)	Cal-cium (mg)	Iron (mg)	ß-carotene equivalents* (µg)	Niacin (mg)	Thiamin (mg)	Vitamin C (mg)
Unseeded flesh mature, boiled[1]	103	2.5	18	0.2	30	0.7	0.08	22.0
Unseeded flesh ripe, boiled[3,4]	na	na	na	na	8–157	na	na	na
Seeded flesh ripe, raw[2]	122	1.1	24.5	1.4	na	1.9	0.12	34.4
Seeded flesh ripe, boiled[3,4]	na	na	na	na	145–939	na	na	na
Preserved, fermented[2]	130	2. 4	18.8	0.6	na	0.9	0.02	3.2
Preserved, dried paste[2]	283	5.1	134.0	0.8	na	7.4	0.14	na
Seeds[1]	155	3.0	69	0.7	0	6.0	0.34	6.1
Rice, white, boiled[1]	123	0.8	4	0.3	0	0.6	0.03	0

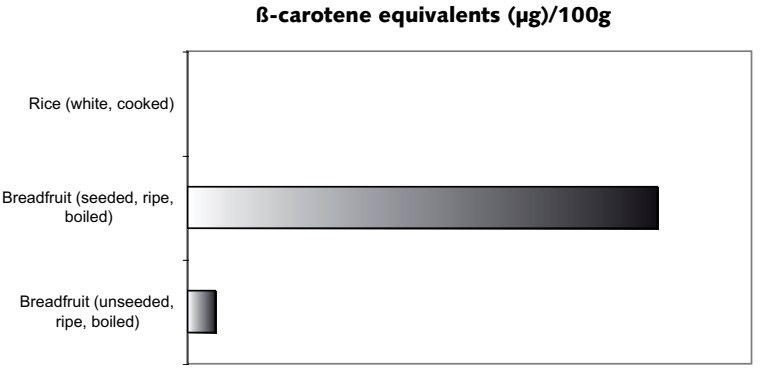
[1]Dignan et al. 2004; [2]Murai et al. 1958; [3]Englberger et al. 2003(a); [4]Englberger et al. 2003(b); na= not available.
*Energy expressed as kilocalories; †provitamin A carotenoids expressed as the sum of the ß-carotene plus half of the ß-carotene.

Note: 1 cup of breadfruit is about 250 grams.









Note: levels refer to the breadfruit flesh and not the seeds.

Breadfruit is rich in fibre, which is important for a healthy gut. 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 compares well with rice for other nutrients. It 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 can meet daily needs for vitamin C. Rice is very low in both nutrients.

The flesh of ripe, seeded breadfruit is particularly rich in provitamin A carotenoids. Consuming these may help protect against infection, diabetes, heart disease, and cancer and help maintain good eye health and vision and strong blood. Two cups of ripe seeded breadfruit eaten at lunch and dinner provides 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. Fermented breadfruit is also rich in energy and contains similar levels of nutrients to fresh breadfruit, except for some vitamins such as vitamin C and thiamin, which are less stable.

In some Pacific regions, there is a trend towards adding sugar to breadfruit. This practice should be avoided as too much refined sugar leads to more tooth decay and other health problems including diabetes.

Using breadfruit

Breadfruit is used at different stages of maturity. The earliest stage is when the white milky sap comes to the surface and runs over the outside; the fruit is still hard and green but mature. If the breadfruit is allowed to ripen, some of the starch in the fruit turns to sugar, making it sweeter and giving it a characteristic ripe taste. The seeds, very young leaves, and flowers (if picked when just ripe) can also be eaten.

Breadfruit can be eaten in many ways:

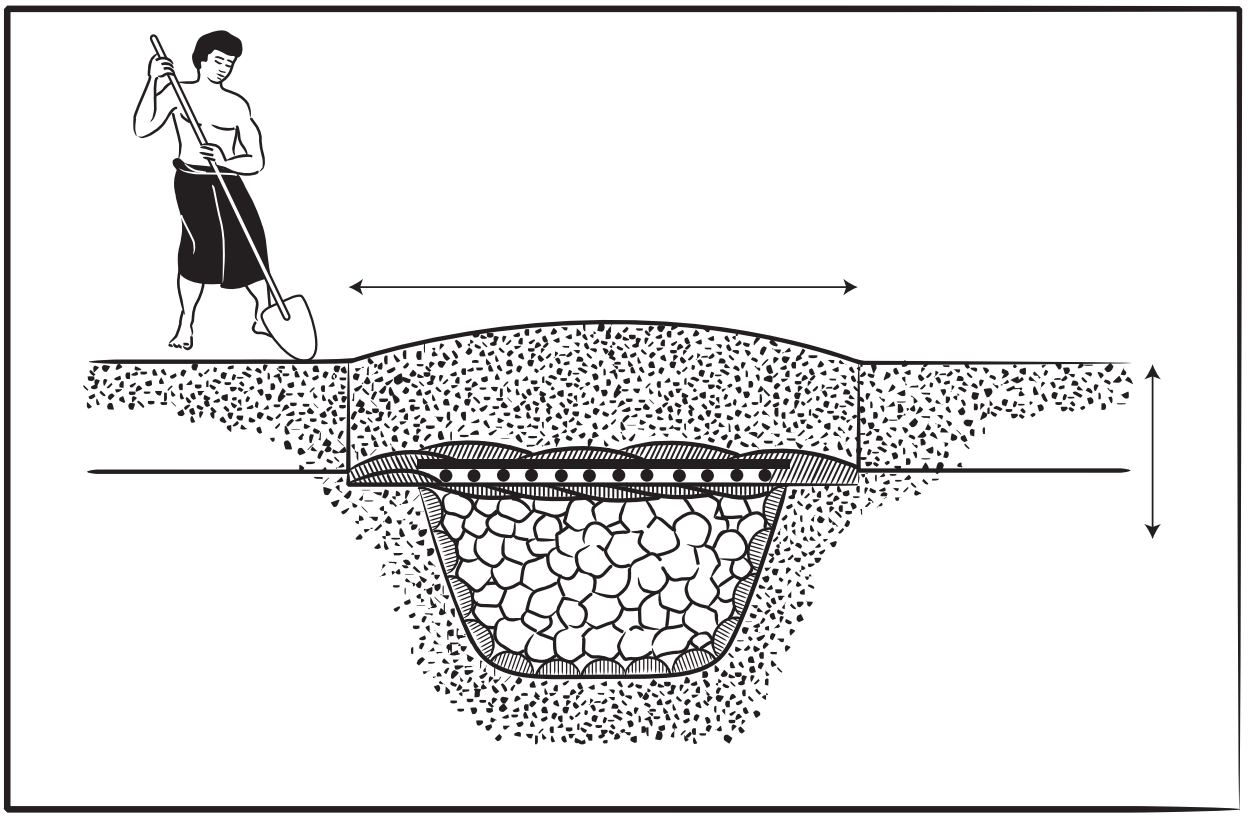
- Fresh and raw as a snack (seeded variety). Any variety can be eaten raw when ripe
- Boiled, steamed, baked, roasted or fried
- Cooked with coconut cream
- As an infant food, from about six months of age
- As bread made from fermented breadfruit
- As a sweet snack made from preserved paste
- Seeds cooked as a snack or part of a main meal

Preparation

Traditional methods of preparing breadfruit include baking in earth ovens (see illustration page 5) and roasting over hot coals. Today, breadfruit is also boiled, steamed, or fried. The fruit can be pricked with a fork before baking or roasting so that it does not break up while cooking. Breadfruit may be peeled before or after cooking.

Breadfruit is very versatile and can be used in dishes such as curry and soup, prepared with fish or meat, or served cold in a salad. It can also be made into chips/crisps by frying thin slices in hot oil.

Breadfruit seeds can be baked or boiled with the flesh, or removed and cooked separately.



Preservation

To keep breadfruit for a short period of time, place it in a cool, dark place, or put it in cold water to keep it for a longer period. Baked breadfruit can be kept for one to two days without refrigeration.

Drying: Breadfruit can be preserved by drying, fermenting or freezing. Breadfruit pieces can be dried in the sun, in a slow oven (50˚C or 120˚F) or in a dehydrator. When well dried and cool, seal it in plastic bags to keep out moisture. Dried breadfruit is excellent in soups and stews. Another way of drying breadfruit is to cook it first, then mash it into a paste. Dry the paste in the sun and store in airtight containers. Breadfruit paste prepared from seeded breadfruit is now rarely made, but it is a tasty sweet snack.

Making flour: To make breadfruit flour, pound dried breadfruit, or grind it if a grinder is available. Sift and repeat. Store the flour in an airtight jar. It can be used instead of wheat flour in many recipes.

Fermenting: Fermented breadfruit is still popular in parts of the Pacific. In traditional methods, breadfruit may be fermented by peeling, coring and cutting up the fruit and burying it in pits lined with banana or breadfruit leaves, which are then covered with more leaves, sacks, earth and stones. In some methods, the breadfruit is first soaked in seawater. Today, breadfruit is usually fermented by placing the peeled fruits in an airtight container, e.g. a plastic container. Once the breadfruit is fermented, which takes about two to three months, it may be used in a number of recipes. To get rid of the strong fermented taste, the dough is rinsed with clean water before being kneaded and mixed with other ingredients such as coconut cream, grated coconut or ripe mashed banana.

Freezing: Freezing breadfruit changes the taste and texture, but still preserves it well for some recipes. Frozen, raw breadfruit can be lightly stir-fried, or boiled and mashed (with some fish) to make tasty breadfruit patties that are then grilled or fried. Frozen, cooked breadfruit can be reheated over steam or used in stews or soups.

Recipes

Breadfruit salad

- 2 cups cooked mature breadfruit
- 1 cup finely sliced vegetables, such as cucumbers, Chinese cabbage, or carrots
- 3 tablespoons chopped onion
- 1–2 tablespoons lime or other citrus juice
- 1 chopped hard-boiled egg, optional
- 1 chopped clove garlic, optional
- 1–2 tablespoons oil or salad dressing, optional

1. Cut the cooked breadfruit into cubes.
2. Combine all ingredients.
3. Serve on greens such as watercress, or on edible hibiscus for a decorative touch.

Note: As a variation, root crops such as taro or yam can also be added.

Breadfruit and fish curry

- 2 cups raw mature breadfruit, peeled and cut into pieces
- 1–2 tablespoons cooking oil
- l large onion, chopped
- 1–2 cloves garlic, diced
- 1–2 teaspoons curry powder
- ¼ teaspoon pepper and chili, optional
- 1 tablespoon tomato paste
- 1 cup pumpkin, chopped
- 2 cups green leafy vegetables
- 1 cup chopped vegetables, such as eggplant, carrot or tomato, optional
- 1 cup fresh or canned tuna or mackerel
- 1–2 teaspoons lime or other citrus juice

1. Heat oil and lightly cook onion and garlic for 1 to 2 minutes.
2. Add the rest of the ingredients except the fish and lime or other citrus juice.
3. When the breadfruit and vegetables are cooked, add the fish and cook for 1 to 2 minutes, just until cooked.
4. Add the lime or citrus juice shortly before serving.

For health reasons it is best to avoid adding salt or sugar to recipes if possible. Most canned tomato paste and canned fish both contains added salt.

Ripe and mature breadfruit in coconut cream

- 1 breadfruit, mature
- 1 breadfruit, half ripe
- 1 coconut, grated

1. Wash, peel and core breadfruit and cut into pieces.
2. Boil breadfruit in water until cooked, and drain.
3. Mash the breadfruit.
4. Add a little water to the grated coconut and squeeze the coconut cream over the mashed breadfruit.

Breadfruit and coconut balls

- 3–5 breadfruit (smooth skinned varieties)
- 3–4 coconuts, grated

1. Wash, peel and core breadfruit and cut into pieces.
2. Boil breadfruit in water.
3. Remove a portion of the breadfruit and mash while still hot. The remaining breadfruit should be left cooking over a low heat to keep it warm for mashing (this keeps it sticky and holds the balls together).
4. Roll pieces of mashed breadfruit in freshly grated coconut, forming balls of about 5 centimetres (2 inches) in diameter.

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Coconut

pacific food leaflet n° 4

ISSN 1018-0966

The coconut tree is the 'tree of life' or 'divine tree' of the Pacific Islands. Apart from its value as a food for humans and livestock, it provides wood for building, material for weaving, leaves for shelter and oil for cooking. When dried into copra, it is also an important source of income.

Varieties of coconut trees

The coconut tree, with its long trunk and crown of waving fronds, is a symbol of the Pacific. There are many varieties of coconut trees, for example 'talls', 'dwarfs' or hybrids between them. Tall varieties often live for 70 years or more. Many varieties have local names that refer to their main use or appearance.

Dwarf varieties flower about three to four years after planting and because they are low-bearing they are easier to harvest. The tall varieties flower in about eight years. Some varieties have large nuts, while others have many small ones. Other differences include skin colour and the amount of milk and meat. One variety is known for its edible husk, which is chewed and sucked in the raw or cooked state.

Coconut trees bear nuts all year round. The nuts grow from flowers produced in the axils of the leaves. They are either harvested when they are young, or left to ripen and fall. It takes about a year after the tree flowers for the nut 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.

Design and layout: Muriel Borderie. Illustrations: Jipé Lebars

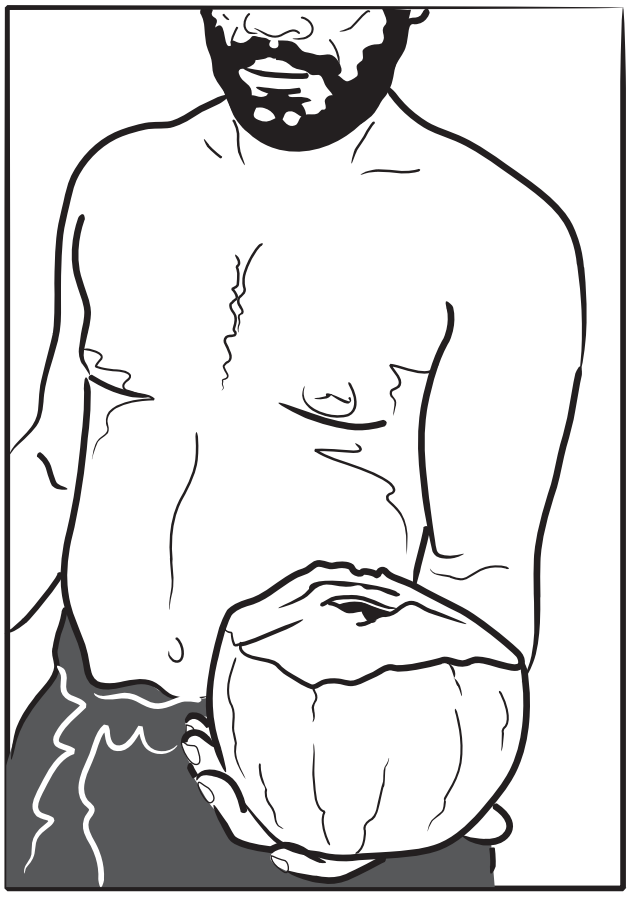
Coconut products

Food uses

Coconuts are eaten at different stages and in many different ways. Some of these are described below.

Immature (or drinking) coconut

These young nuts have either a green or orange outer surface. They contain large amounts of a clear sweet liquid called **coconut juice** or **coconut water,** which is used as a drink. The jelly-like white flesh inside the very young drinking coconut is called **immature flesh** or **coconut jelly.** It can be eaten as a snack or used in salads or 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 coconut

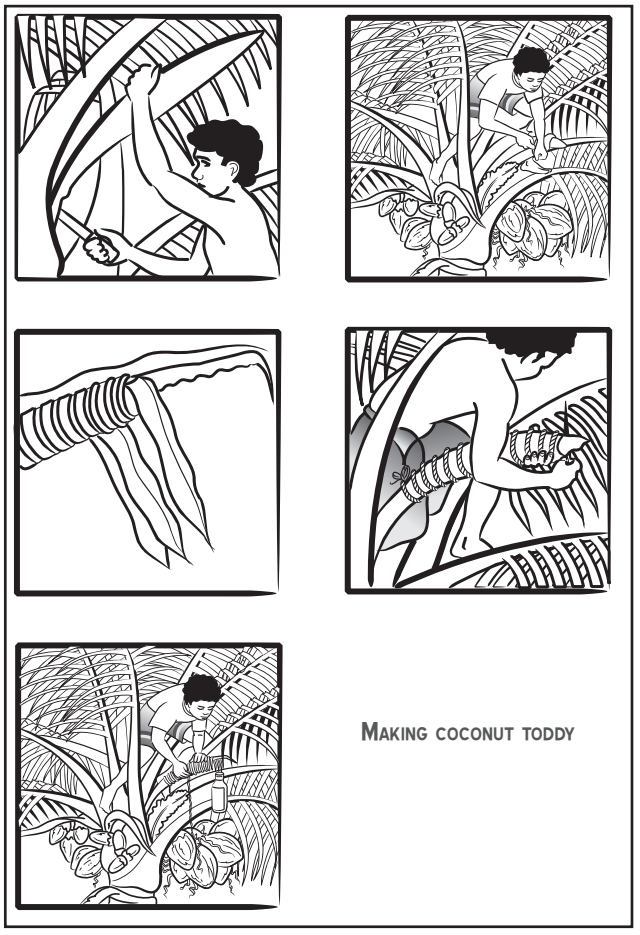
These older coconuts have a brown outer surface. They contain a small amount of liquid called **mature coconut water,** which is only sometimes consumed. The mature coconut contains a thick layer of firm white flesh, which is called **mature flesh** or **meat** or sometimes **copra** (copra is the term used to describe the flesh when it is processed for sale). The flesh is eaten as a snack or grated and used in cooking. The grated coconut is also squeezed to extract an emulsion called **coconut cream.** If water is added to help extract the liquid, a thinner liquid is produced, which is called **coconut milk** or **coconut cream, water added**. If made without adding water, it is called **coconut cream, no water added**. Coconut cream is used in many recipes.

Coconut oil

Coconut oil is used in cooking and also as a body oil to which scents are added. It is prepared by gently boiling coconut cream until only the oil remains or by grating mature coconut, drying it in the sun, and using pressure to extract the oil.

Coconut toddy

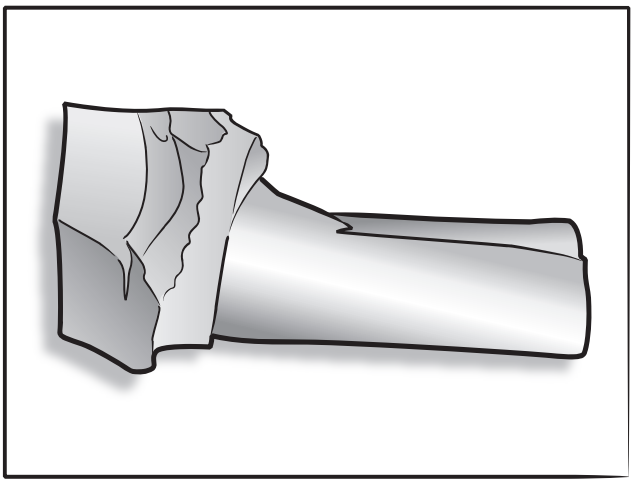
Toddy is produced by binding and cutting a newly formed coconut bud. Paper-thin shavings are sliced off twice a day so that the dripping sap continues to flow. The sap (about half a litre per day) is then collected in either a specially prepared coconut shell or bottle, which must be kept very clean. 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 breastmilk after six months of age.



Making coconut toddy

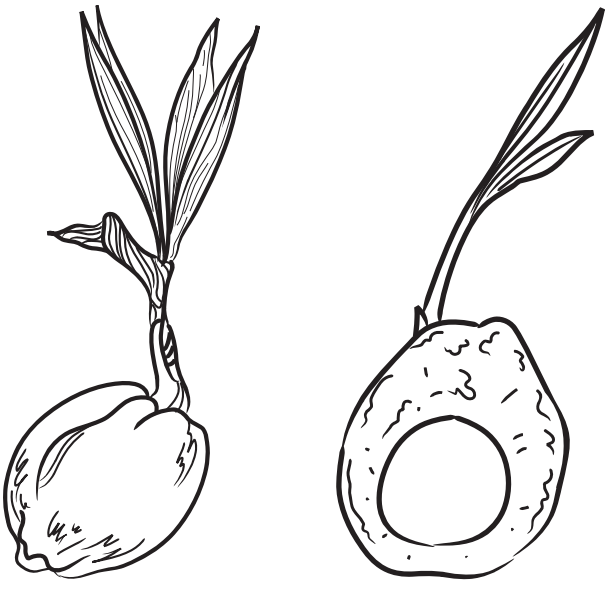
Heart of palm

The heart of palm is the central area of the palm (2–3 kg/palm) that the leaves and flowers grow from. Because removing it will kill the tree, it is only eaten rarely as coconut palms are so precious. It is eaten as a snack or made into a salad, sometimes called 'millionaire's salad'.



Sprouted coconut

When a coconut begins to sprout or germinate, it is called **sprouting** or **germinating coconut**. A spongy, sweet, white mass of tissue forms inside the seed cavity and is referred to as the **coconut apple**. It absorbs the **endosperm** or **embryo,** also called the **meat.** The **coconut apple** can be eaten raw as a snack, or cut up or mashed for use in different recipes.



Husk

The husk of some coconut varieties is eaten, especially on some atolls. It is very sweet and is chewed for its juices, similar to chewing sugar cane. On some islands in Micronesia, people believe that eating this husk helps people recover more quickly from an illness.

Fermented ripe nuts

These nuts have tough flesh, which is sour and oily. People who eat them enjoy the special flavour.

Non-food uses

Coconut products are used by people around the world. Oil pressed from copra is used in soaps, cosmetics and hair oil. 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 for making mats, baskets, hats, brooms, fans and thatching. Palm mid-ribs are used to make fences, walls, tongs, toys and whistles. The trunk contains a very hard wood that is excellent for furniture and fence posts. Charcoal is made from any waste trunks or shells and the husks are used for firewood and to make cocopeat for potting mix.

Nutrition

Coconut products differ in their nutrient content. Coconut oil is almost 100% fat with no carbohydrate, whereas boiled coconut toddy is almost half carbohydrate with almost no fat. As it matures, the flesh of the coconut becomes higher in fat and energy.

Coconut oil, mature coconut meat and coconut cream are all high in energy (calories). A small amount of coconut cream added to local root crops and starchy fruits makes a good energy food for young infants (after six months of age). The soft flesh of a young drinking coconut is also a suitable food for infants and children.

Coconut toddy is an excellent source of vitamin C, which is important for fighting infection and also helps the body absorb some forms of iron. One cup of fresh toddy provides more than the estimated daily requirement of vitamin C for most adults (45 milligrams). Coconut juice, sprouted coconut, and the flesh of immature and mature nuts are also good sources of vitamin C.

Some coconut products are also a good source of iron, which is needed for building strong blood.

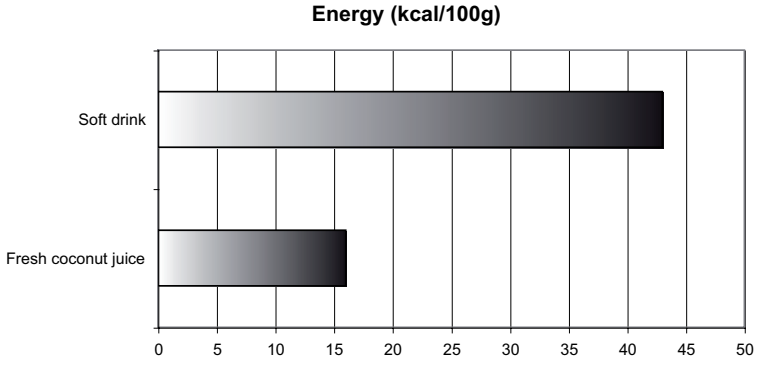
Many coconut products contain niacin, riboflavin, and thiamine (essential B vitamins), which are important for body metabolism.

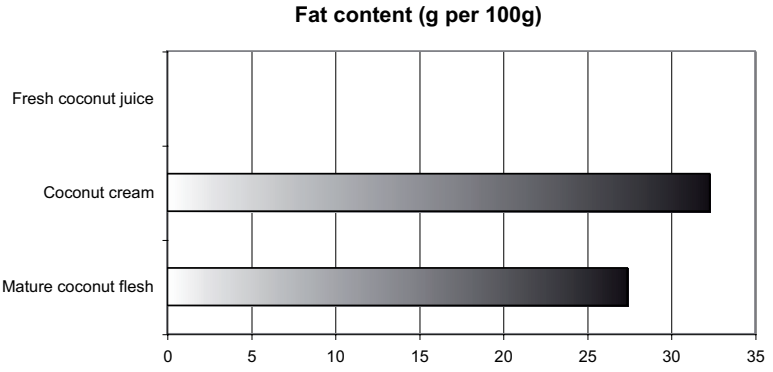
The drinking coconut contains a refreshing nutrient-rich liquid. The juice can also be given to people with diarrhoea to replace lost fluids and minerals. Soft drinks contain few nutrients (see table) and may be harmful to health because they often contain a large amount of refined sugar.

Comparison of 100 gram (g) edible portions of coconut products, processed baby food and soft drink.

Food item	Kcal*	Protein (g)	Fat (g)	CHO (g)	Fibre (g)	Calcium (mg)	Iron (mg)	Niacin (mg)	Vitamin C (mg)
Sprouting coconut[1]	74	1.3	3.6	8.5	1.8	19	0.7	0.9	6
Coconut flesh, mature[1]	283	3.0	27.4	3.6	7.6	10	1.0	0.6	7
Coconut flesh, immature[1]	81	1.8	5.9	3.8	3.2	2	1.3	3.6	3.8
Coconut cream, fresh, no water[1]	325	4.4	32.3	4.7	1.7	15	1.8	0.5	1.0
Coconut water/ juice, immature nut[1]	16	0.1	0	3.9	0	12	trace	2.8	1.4
Coconut water, mature nut[1]	22	0.3	0.2	4.9	0	29	0.1	0.1	2
Coconut toddy, fresh	42	0.2	0.4	9.6	0	trace	trace	0.2	20
Coconut toddy, boiled[2]	217	0.9	2.1	49.4	0	trace	trace	trace	**
Coconut oil	883	trace	99.9	0	0	2	trace	trace	0
Baby food, apple and apricot[1]	45	0.2	0.2	9.8	1.8	6	0.3	0.1	18.0
Soft drink, cola[1]	43	0	0	10.9	0	trace	0	0	0

[1]Dignan et al. 2004; [2]Murai et al. 1958; na = not available.
*Energy expressed as kilocalories





**Available information may not be accurate.

Fat content of coconut

Fats are molecules made of building blocks called fatty acids. These are classified using two methods: (1) saturation and (2) molecular size. According to the first method, there are two basic types of fatty acids: saturated and unsaturated. The unsaturated fatty acid group includes monounsaturated and polyunsaturated fatty acids. The second classification method, molecular size, refers to the length of the carbon chain. There are long-chain, medium-chain and short-chain fatty acids.

All fats and oils consumed by humans are mixtures of saturated and unsaturated fatty acids with different chain lengths. These groupings are important because they pose different health risks. In particular, there is strong evidence of a link between a high intake of saturated fat and heart disease. In general, animal fats (found in meat, milk, cheese and eggs) contain more saturated fats. Coconut also contains high levels of saturated fats.

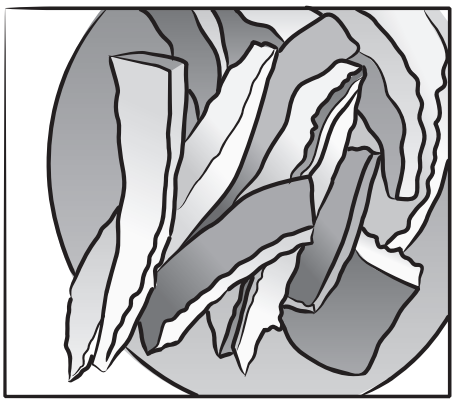
However, coconut oil is very different from other fats because it mainly consists of medium-chain fatty acids or medium-chain triglycerides (MCTs), which are also found in human breastmilk. These may have health-giving properties; for example, protection against heart disease. Most natural fats are made up of long-chain fatty acids.

Studies have shown that a high intake of coconut is not linked with a risk of heart disease within a traditional lifestyle that includes enough physical activity, a diet with plenty of fish, root crops, starchy fruits and vegetables, low salt intake and minimal use of tobacco and alcohol. However, consuming too much fat from any source carries health risks.

Preservation

Coconut cream can be frozen or canned. Both **mature** and **immature coconut flesh** can be frozen by packing it tightly in plastic bags before freezing. Another way of preserving coconut is to dry grated coconut in a very slow oven or to sun-dry it as described below.

Toddy can be used to make many food products. When fresh toddy is allowed to ferment, the **yeast** that develops can be used to make bread. **Vinegar** can be made by leaving fresh toddy to ferment to an acid stage. **Palm syrup** is made by boiling toddy until it is thick. It can then be mixed with four parts water to one part palm syrup to make a sweet drink. Palm syrup is also used in traditional recipes for sweetening.



Dried grated coconut

1. Grate the flesh of a mature coconut.
2. Spread the grated coconut on a tray and put it in the sun to dry.
3. Dry it for 2 to 3 days, stirring it regularly so that it dries evenly.
4. It is ready when it feels dry. Dried grated coconut will keep for several weeks if stored in a dry place. It can be used for baking or in fruit salads.

Recipes

Coconut husk snack (*Apior* from Pingelap, Pohnpei, Federated States of Micronesia)

- 1 husk of a coconut variety with edible husks
- 1 coconut, grated

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.

Sprouted and drinking coconut salad

(*Dalok* from Pingelap)

- 2 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 good for the health.

Fish in coconut cream

One serving

- 2 tablespoons canned or fresh fish (cooked)
- 4 tablespoons taro, cooked and mashed
- 4 tablespoons taro leaves, cooked and mashed, optional
- 4 tablespoons thick coconut cream

1. Mix all ingredients together.
2. Cook the mixture for 5 minutes in a pot.
3. Cool and serve.

Note: This dish can also be used as an infant food from six months of age.

Pumpkin pudding

Six servings

- 6 medium drinking coconuts with good flesh inside
- 3 cups pumpkin, peeled and cut into pieces

1. Cut the tops off the coconuts. Pour the coconut water into a bowl.
2. Put the pumpkin pieces in the coconut shells and pour the coconut water over the pumpkin.
3. Bake in an earth oven or other oven at a moderate temperature (180°C or 350°F) for about 1 hour.
4. Cool and serve.

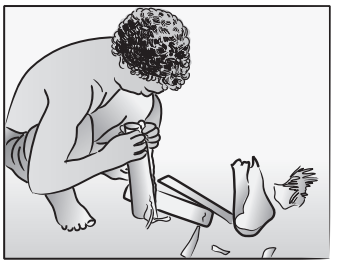
Green coconut drink

Ten servings

- 6 drinking 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 with the coconut water. Prepare the fibre from the inside of a coconut palm mid-rib to whip the mixture. Cut the fibres very thin (because they are stiff, they 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 breastfeeding mothers and for babies and children after the age of six months.



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Taro

pacific food leaflet n° 5

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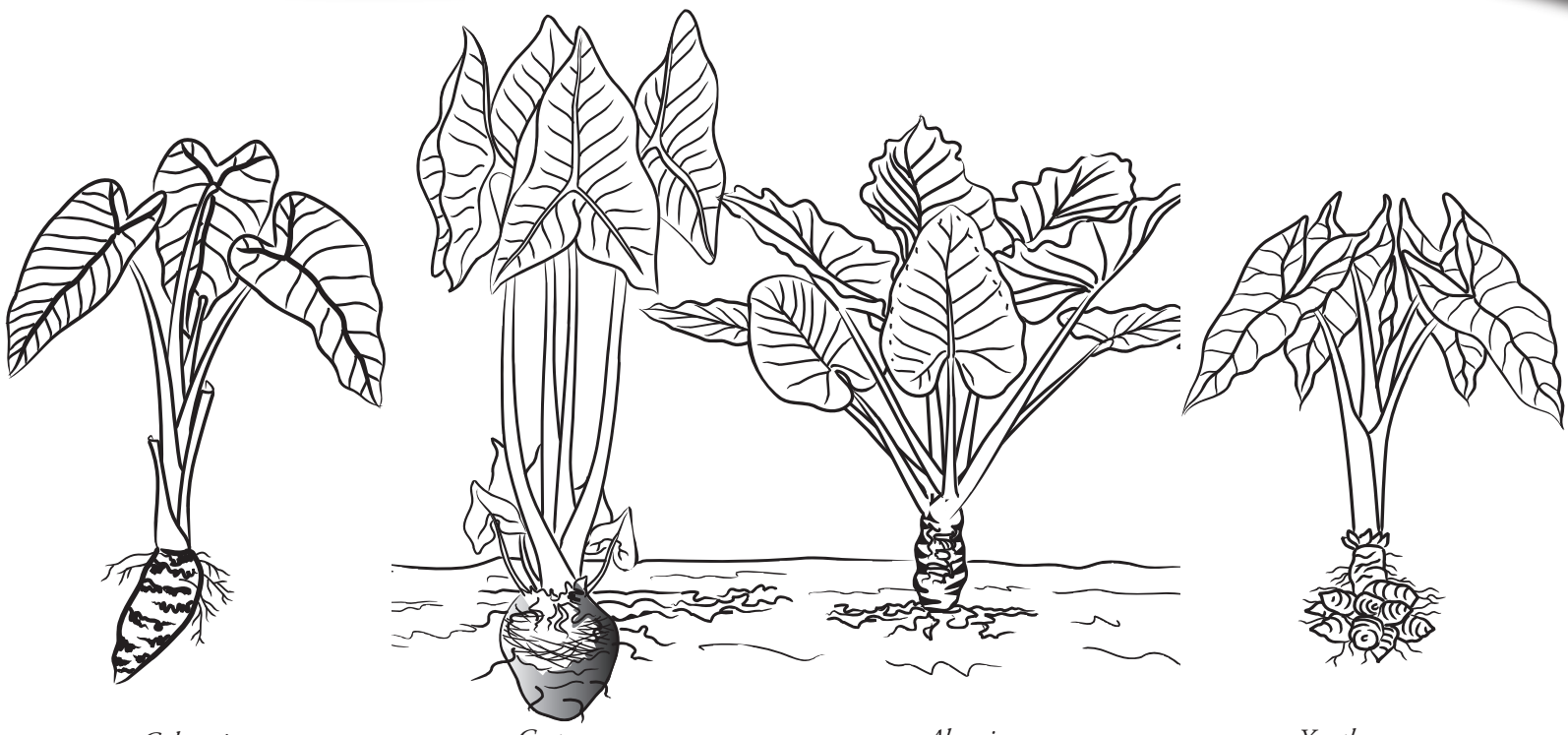


Colocasia *Cyrtosperma* *Alocasia* *Xanthosoma*

Taro is an important staple food crop in the Pacific and has been for thousands of years. Although taro is increasingly being replaced in the diet by imported products, it remains a treasured food with many different uses. It is also very nutritious and is an important part of a healthy diet.

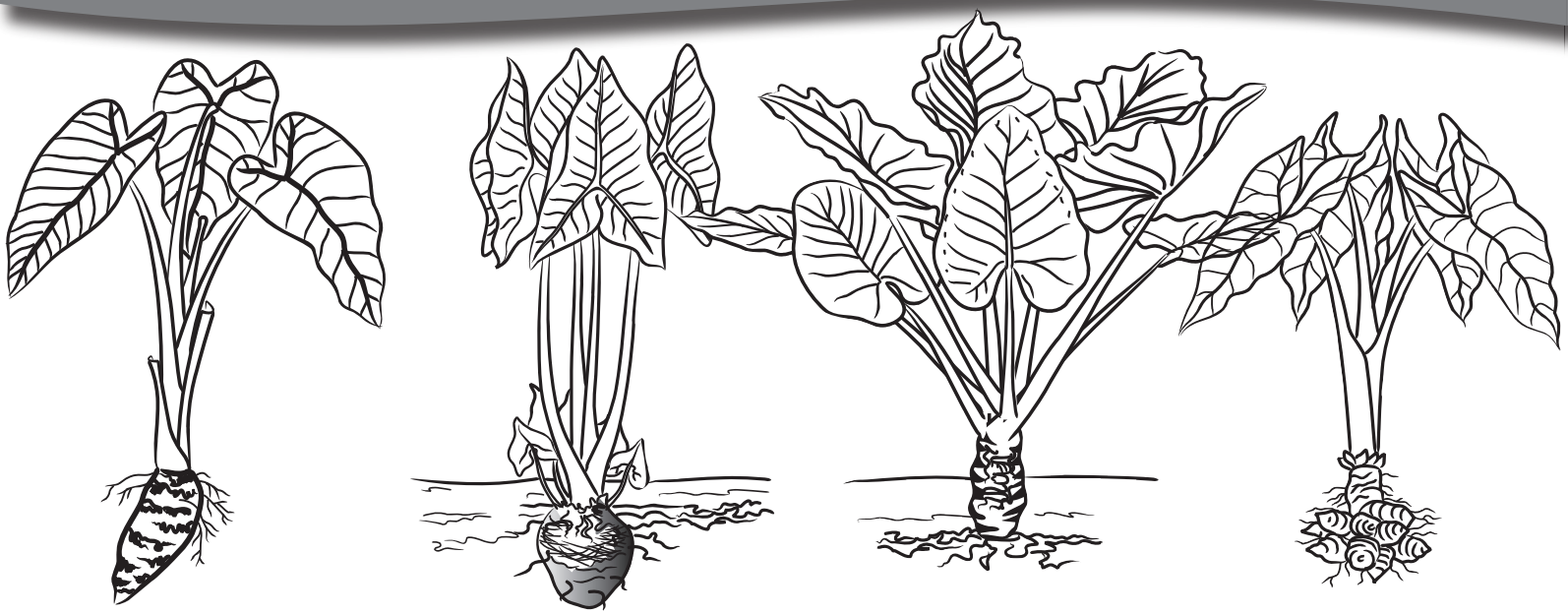
Main types of taro

There are four types of taro in the Pacific Islands; all except *Xanthosoma* are native to the Pacific. *Colocasia* taro is the most widespread type with many varieties. It is mainly grown for its corm, but in some areas the stalks and leaves, which are non-vertical, are also eaten after cooking. Usually this taro is grown in rain-fed 'dry' land, but some varieties are able to grow in irrigated terraces or swamps. The crop is important in local customs.

Cyrtosperma taro, also called giant swamp taro, is a much taller plant with large arrow-shaped vertical leaves and large coarse corms. It is the main root crop of atolls as it can grow in sandy saline soil and can withstand high winds. Like *Colocasia*, giant swamp taro plays an important role in many social occasions. *Alocasia,* or giant taro, is a hardy plant that can grow in a wide range of soil types. It also has vertical leaves, but has long corms that rise above the ground. *Xanthosoma* is an easily grown taro from tropical America that was brought to the Pacific about 100 years ago. It does better than *Colocasia* in dry conditions. Unlike the other taro, the cormels (small corms growing out of the central corm) are eaten rather than the central corm. Like *Alocasia*, it is a hardy plant that will grow in less fertile soil that is unsuited to growing *Colocasia*. Most taro have the irritating acridity factor; that is, all parts of the plant can irritate the skin, mouth and throat. Some types are worse than others. In particular, if *Alocasia* corms are not prepared properly, they can irritate the throat.

Design and layout: Muriel Borderie. Illustrations: Jipé Lebars

Taro



Colocasia *Cyrtosperma* *Alocasia* *Xanthosoma*

The many types and varieties of taro vary greatly in appearance, use, taste and other properties. It is important to conserve these varieties and the knowledge associated with them so they can be handed on to future generations.

Taro was almost wiped out in Samoa in the early 1990s due to a fungal disease (taro leaf blight) to which Samoan varieties had no resistance. However, as a result of introducing resistant varieties from other countries and an excellent breeding program that has developed further resistant varieties, taro is again being cultivated successfully in Samoa.

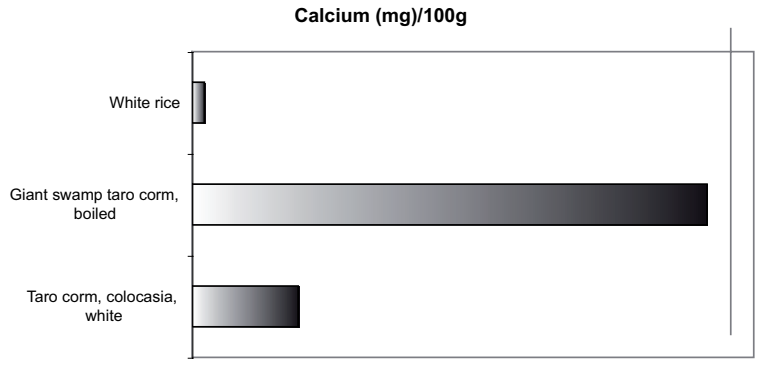
Nutrient content

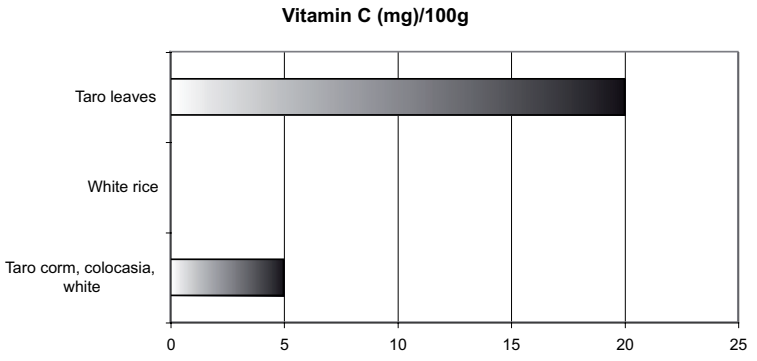
Taro, like other staple food crops in the Pacific, is rich in nutrients, particularly compared to white rice.

Comparison of nutrients in 100 gram (g) edible portions of boiled taro and white rice.

Food item	Kcal*	Fibre (g)	Calcium (mg)	Iron (mg)	Zinc (mg)	ß-carotene equiv.† (µg)	Thiamin (mg)	Vitamin C (mg)
Taro corm, *Colocasia*, white[1]	99	0.8	34	1.0	0.8	38	0.08	5
Taro corm, *Colocasia*, yellow[1]	126	1.0	44	1.3	1.0	38	0.11	7
Giant swamp taro corm, *Cyrtosperma*,[1] colour unspec.[1]	72	2.5	165	0.6	1.9	27	0.02	7.9
-white/ creamcoloured[3,4]	na	na	na	na	na	55-300	na	na
-yellow-coloured[3-5]	na	na	240-1440	1.4-3.6	4.1-63	460-4486	na	na
Taro corm, *Alocasia*[2]	79	1.8	169	0.9	na	na	0.10	1.1
Taro leaves, *Colocasia*[1]	28	2.5	214	1.7	0.3	4973	0.06	20
Taro stalk,*Colocasia*[1]	26	0.7	114	1.9	0.4	94	0.00	2
Rice, white[1]	123	0.8	4	0.3	0.6	0	0.03	0

[1]Dignan et al. 2004; [2]Murai et al. 1958; [3]Englberger et al. 2003a ; [4]Englberger et al. 2003b; [5]Englberger et al. (unpublished); na= not available.
*Energy expressed as kilocalories; †provitamin A carotenoids expressed as the sum of the ß-carotene plus half of the ß-carotene.
Note: one heaped cup of cooked taro corm or rice weighs ~250 g.





Taro corm is an excellent source of the energy that the body needs for warmth, work and play. The corms, particularly of giant swamp taro (*Cyrtosperma*) and taro leaves (*Colocasia*) are rich in fibre, which is needed to make the intestines and bowels work properly. Fibre also helps to control blood sugar in diabetics and reduce blood lipids, which are a risk factor for heart disease. People who eat foods rich in fibre are less likely to be overweight.

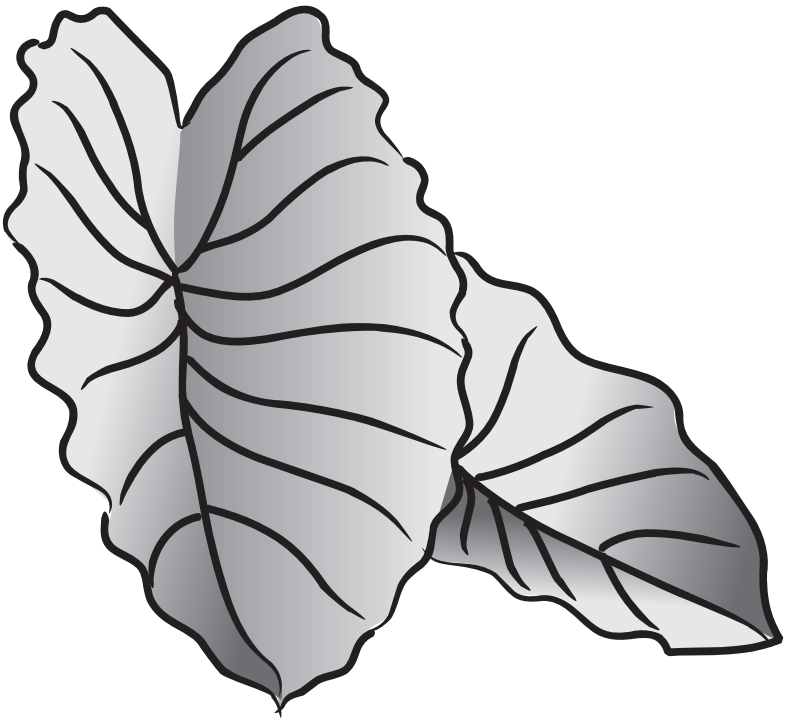
Taro corms are good sources of the essential minerals, calcium and iron. Calcium helps to make strong bones and teeth, and iron helps keep the blood healthy. Women and growing children, in particular, need lots of iron in their diet.

Some giant swamp taro (*Cyrtosperma*) varieties are also a rich source of zinc, which is an essential mineral that protects against infection, builds the blood and protects against vitamin A deficiency. Taro is one of the few non-animal sources of zinc.

Benefits of yellow-fleshed varieties

New findings show that varieties of giant swamp taro with yellow-fleshed corms contain significant amounts of provitamin A carotenoids, which are changed in the body to vitamin A. The most important of these carotenoids is ß-carotene.

Vitamin A is important for good vision and eye health and helps to fight against infection and build blood. Consuming two cups of yellow-fleshed giant swamp taro a day may provide over 100% of the estimated daily requirements for vitamin A. Eating carotenoid-rich food may also help protect against diabetes, heart disease and cancer. Cooking food at moderate temperatures and for a reasonable period does not destroy carotenoids and may even enable the body to use the carotenoids more easily.



Leaves

Colocasia taro leaves are excellent sources of provitamin A carotenoids, calcium and fibre. The leaves are also excellent sources of vitamin C, which 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 that 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.

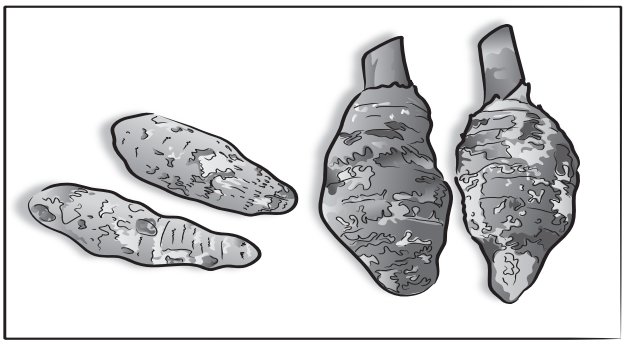
Storage and preservation

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* 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 will keep for about a week. Yet another method is to partly boil the corm, slice it thinly and then dry the pieces in the sun.

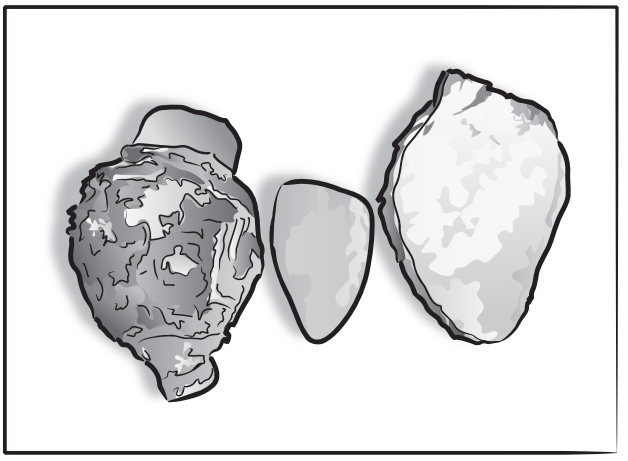
Freezing is a very good method of preserving *Cyrtosperma* corms. The corm can be grated and then frozen in clean plastic bags. This is useful for some recipes and also cooks quickly. Grated frozen taro is marketed in several areas of the Pacific.



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. They will then 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.

Cooking taro



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. However, as mentioned before, different types of taro, including *Colocasia* and *Alocasia* varieties, have varying levels of acridity and can cause uncomfortable itchiness in the mouth and throat when eaten. To avoid this problem, the corms must be peeled carefully.

Giant swamp taro can also be prepared by grinding the raw corm, mixing it with coconut cream and ripe mashed banana or pulp from pandanus fruit and then baking.

Leaves

When choosing leaves of *Colocasia* taro to eat, pick young leaves with green or pink (not brown or purple) stalks. The leaves of all varieties of *Xanthosoma* can be used.

The leaves as well as the root can make the mouth itch if they are not prepared and cooked properly. To make certain this does not happen, the leaves should be boiled quickly for a few minutes in water, drained and then cooked further in water or coconut cream.

Stalks

The green stalks of *Colocasia* taro make a delicious addition to any meal, although they are eaten in only a few areas in the Pacific (see the recipe for Taro salad (Baseisei) on page 6).

Recipes

Stir-fried taro with vegetables

Four servings

- 2 medium-sized taro corms (*Colocasia*)
- 2 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.
4. Boil vegetables separately for a few minutes until cooked and drain off the water.
5. Stir-fry the taro, vegetables, onion, and spring onion for 1 to 2 minutes and serve.

Taro salad *(Baseisei from Fiji)*

Four servings

- 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 in) 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.

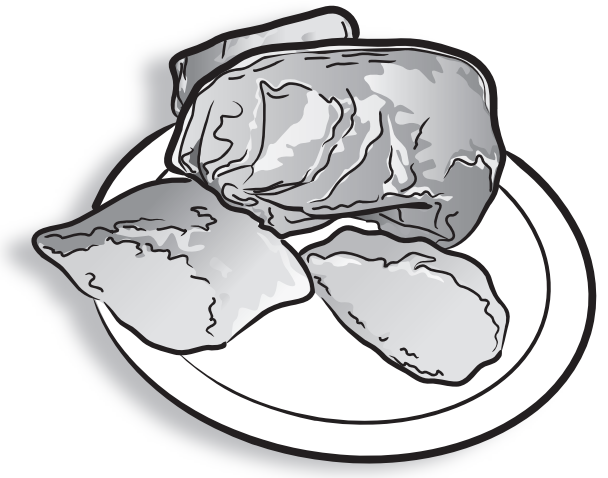
Taro leaves in coconut cream *(Palusami from Samoa)*

Makes 28 parcels

- 12 coconuts
- 4 bundles *Colocasia* taro leaves – about 120 leaves
- 5 onions, chopped
- 7 banana leaves
- 28 breadfruit leaves

1. Grate the coconuts. Using fine cheese cloth or coconut fibre, squeeze out the coconut cream.
2. Choose firm, clean banana and breadfruit leaves.
3. 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.
4. 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 cream. Fold the leaves in carefully, without spilling the coconut cream.
5. Wrap each taro leaf bundle in a piece of softened banana leaf, then cover with a breadfruit leaf. Make a secure parcel by tucking the stem underneath the leaf.
6. Cook the parcels in an earth oven or steam for 30 minutes.

Chopped pieces of meat or fish may be added to the chopped onion before the coconut cream is added to the parcel. If this is done, the cooking time must be increased to at least 1 hour. Aluminium foil can be used to wrap the taro leaf parcels instead of banana and breadfruit leaves.



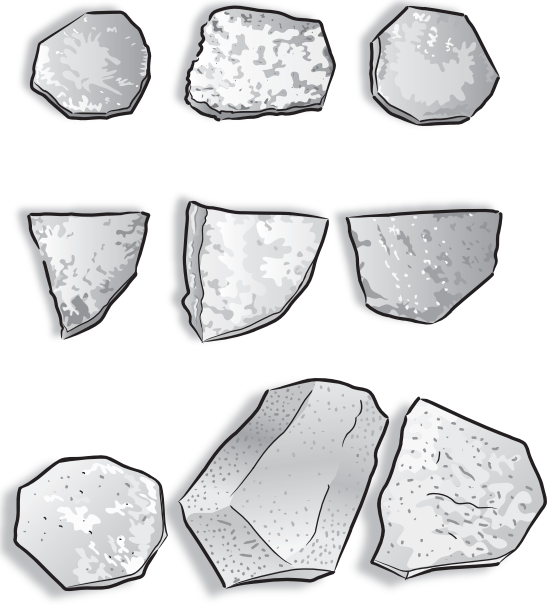
Taro with seafood

Two servings

- 2 cups peeled *Colocasia* taro cut into cubes
- 1 cup shellfish or small fresh fish
- 1 ½ cups coconut cream
- 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 taro.
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 cream 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.

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



Deeper shades of yellow and orange provide an increased amount of caretoneids and thus greater health benefits.

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Pandanus

pacific food leaflet n° 6

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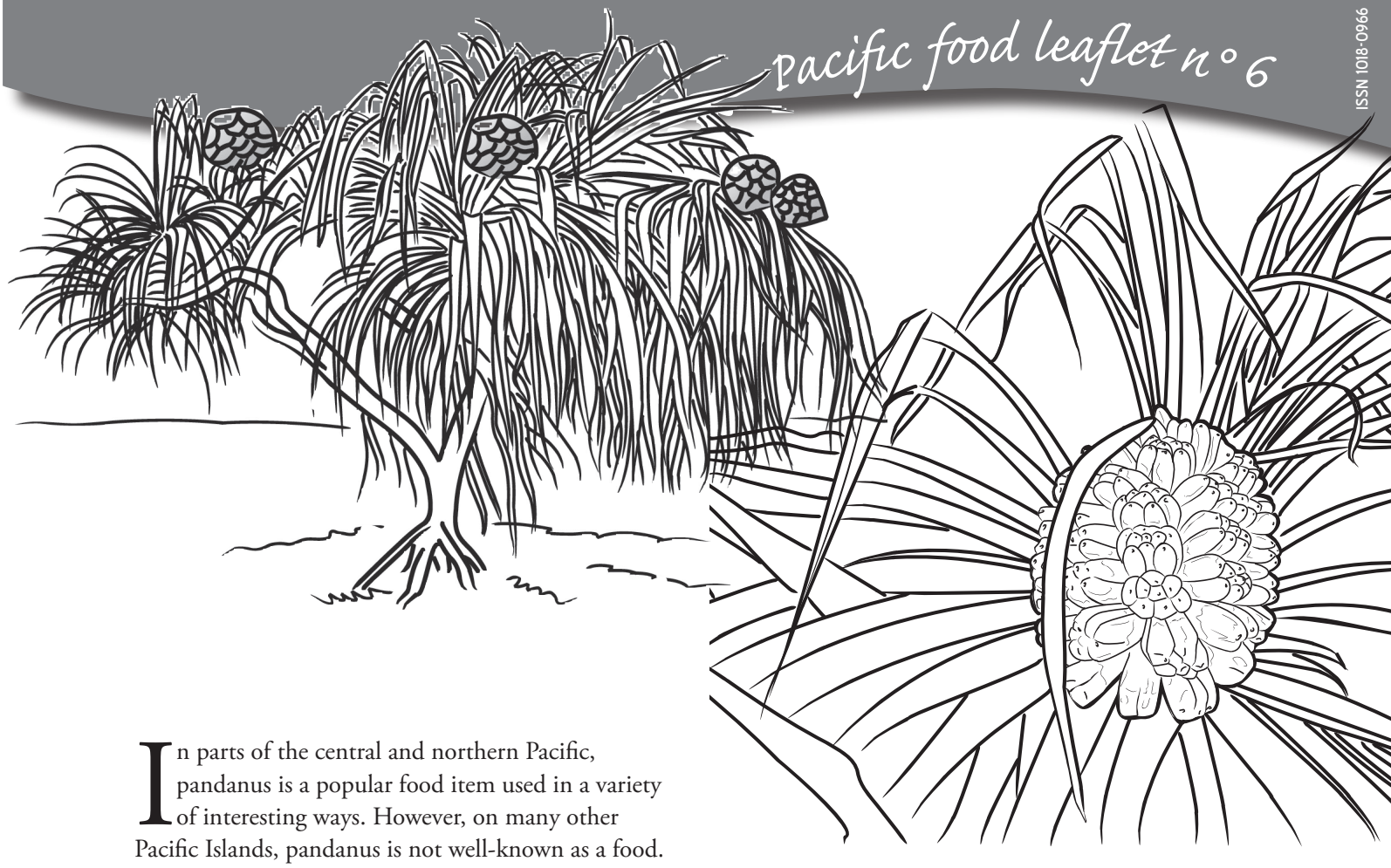


In parts of the central and northern Pacific, pandanus is a popular food item used in a variety of interesting ways. However, on many other Pacific Islands, pandanus is not well-known as a food.

There are many varieties of pandanus, but only some have edible fruits and nuts. 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 nuts of some varieties are also eaten. In some countries, a number of pandanus varieties are conserved in genebank collections.

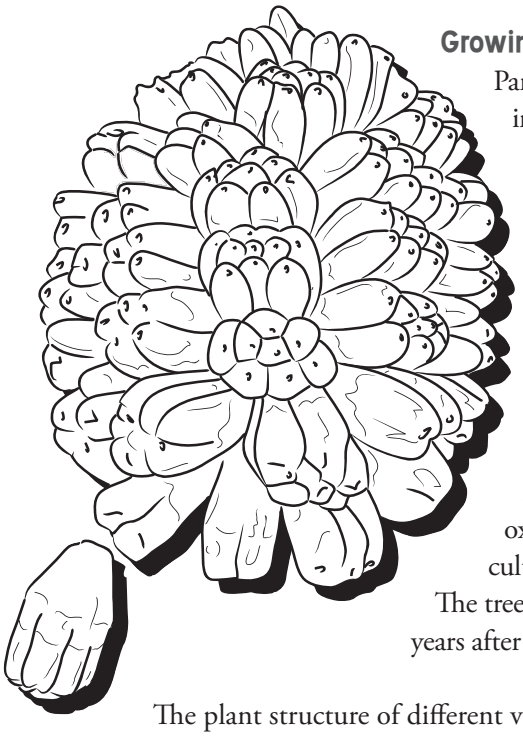
The pandanus plant plays an important role in everyday life in the Pacific. The leaves are used for weaving and thatching and the wood for construction. The bark and flowers are used to scent body oils and the roots are used in making medicines, paintbrushes and rope.

In Kiribati, pandanus is called the 'tree of life' as it provides food, shelter and medicine. In the Marshall Islands, it is called the 'divine tree', like coconut, because of its important role in everyday life. Pandanus is also an important staple food in the Federated States of Micronesia (FSM), Tuvalu, Tokelau and Papua New Guinea. Dried pandanus was once an important food for voyagers on outrigger canoes, enabling seafarers of long ago to survive long journeys.

This leaflet focuses on the *Pandanus tectorius* species of pandanus. However, other species, such as *Pandanus conoideus* and *Pandanus jiulianettii*, which are grown in Papua New Guinea, are also used for food. *Pandanus conoideus* (*marita* or red pandanus) is used to make a sauce and *P. jiulianettii* (*karuka* or highland pandanus) is eaten raw or the nuts are cooked.

Design and layout: Muriel Borderie. Illustrations: Jipé Le-Bars

Some local names for edible pandanus fruits and nuts: *bōb* (Marshall Islands), *choi, fach, far* (Yap, FSM), *deipw, fach, far* (Chuuk), *epo* (Nauru), *fala* (Tokelau, Tuvalu), *te kaina* (Kiribati), *kipar, deipw* (Pohnpei, FSM), *marita, karuka* (Papua New Guinea), *mweng* (Kosrae, FSM), *ongor* (Palau)



Growing pandanus

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 irritating oxalates) must be cultivated from cuttings. The trees fruit about 2 to 4 years after a cutting is planted.

The plant structure of different varieties varies greatly. Some trees grow to a height of about 4 metres and others to 10 to 12 metres. The leaves differ in width, length, longevity and softness. The bunches of fruit may be rounded or long and weigh from 1 to 15 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 nutrient content.

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.

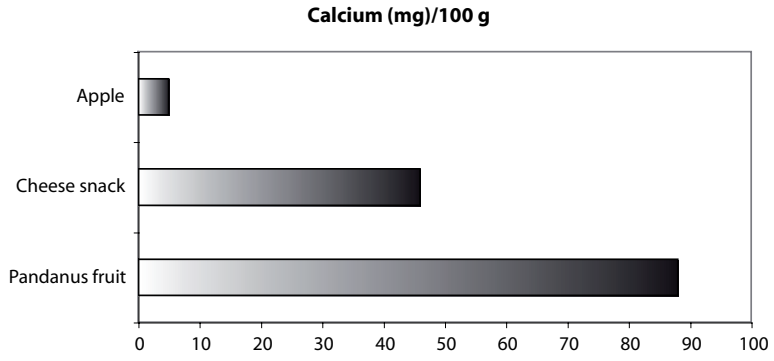
Nutrient content

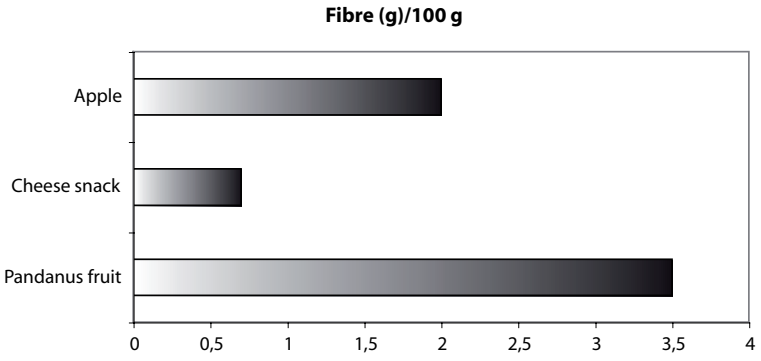
Pandanus fruit is a valuable source of many nutrients, particularly for people living on atolls where only a limited number of food crops can grow due to poor soils and harsh dry climates. The table below compares the nutrient content of pandanus fruit to that of cheese-flavoured snacks and imported apples.

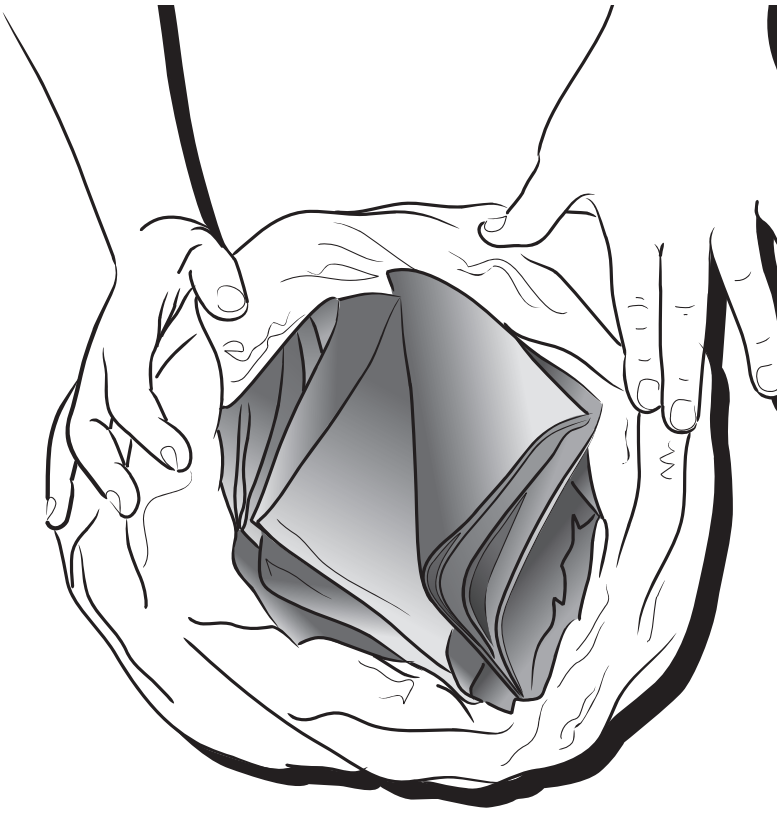
Comparison of 100 gram (g) edible portions of pandanus fruit, cheese snacks and apples.

Food item	Kcal*	Fibre (g)	Calcium (mg)	Iron (mg)	ß-carotene equivalents**(µg)	Thiamin (mg)	VitaminC (mg)
Pandanus fruit, fresh, colour unspec.[1]	86	3.5	88	0.4	60	0.09	5.2
-light-yellow coloured[3,4]	na	na	na	na	19-102	na	na
-deep orange-coloured[3,4]	na	na	na	na	472-941	na	na
Pandanus paste[1,2,4]	293-321	3	134	5.7	155-1080	0.04	2
Pandanus flour[2,4]	196	14	797	1.7	100	0.06	na
Cheese snack[1]	542	0.7	46	0.5	14	0.07	1.0
Apple[1]	54	2.0	5	0.2	10	0.02	5.0

[1]Dignan et al. 2004; [2]Murai et al. 1958; [3]Englberger et al. 2003; [4]Englberger et al. 2005 (a, b); na= not available
*Energy expressed as kilocalories. ** Sum of ß-carotene plus half of the µ-carotene.
Note: The edible portion of one pandanus key weighs 35–100 grams, and a heaped tablespoon of preserved paste weighs 50 grams. One packet of cheese snacks may weigh 100 grams; an apple may weigh 130 grams.







Pandanus contains significant amounts of vitamin C, which is important for fighting infection and for absorbing some forms of iron (needed for building blood). On some islands, eating 10 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, the most important of which is ß-carotene. Provitamin A carotenoids are converted in the body to vitamin A, which is important for good vision and eye health and helps to fight against infection and build blood. Eating carotenoid-rich food may also help protect against diabetes, heart disease and cancer.

Different types of pandanus contain different levels of provitamin A carotenoids; generally, the deeper yellow or orange (or red) the flesh, the higher the level. Consuming 10 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.

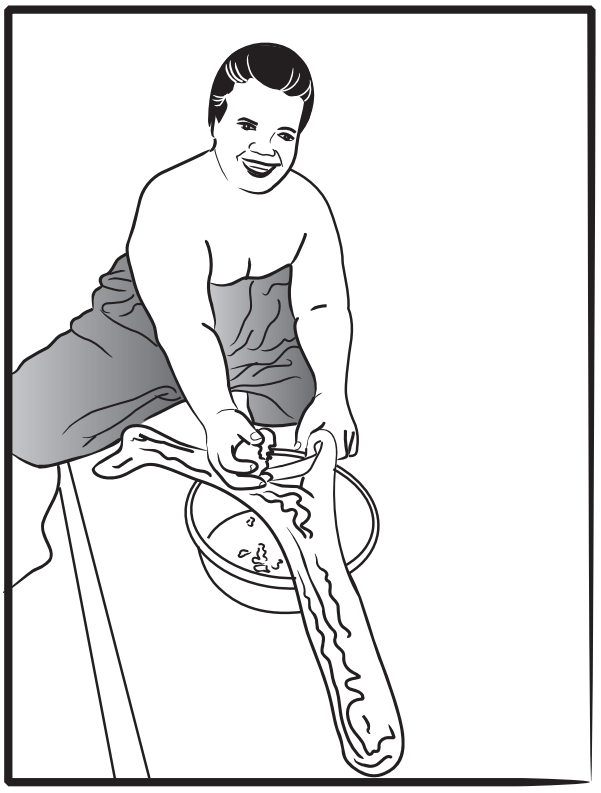
Fresh pandanus fruit are rich in fibre, which is important for a healthy gut. A diet high in fibre also helps to control blood sugar in diabetics, reduce blood lipids (a risk factor for heart disease) and prevent excessive weight gain.

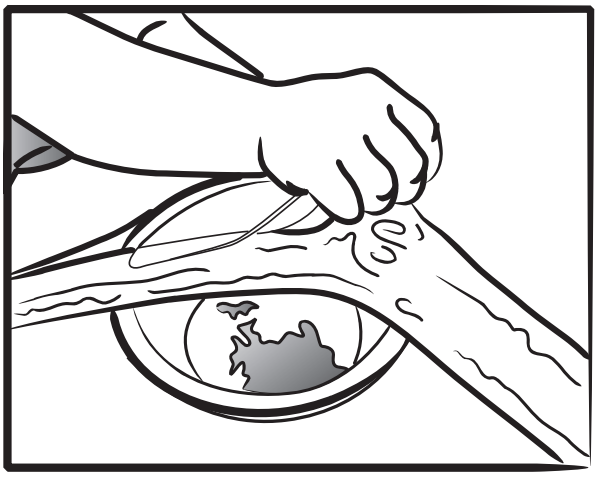
Many people in Micronesia believe that pandanus is a health food and that eating it while ill helps people recover more quickly.

Preparation

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.





Food uses

Pandanus is eaten in many different forms:

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

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 then used in different recipes.

Storage

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 Islands, a number of techniques are used to make pandanus products that can be stored for long periods. These include baking, boiling, drying and/or pounding into a paste or flour.

Dried pandanus paste

This paste called *te tuae* in Kiribati, *mokwan in* the 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 *jennōb* Marshall Islands).

Dried pandanus chips

These chips *te kaka* in Kiribati or *jekaka* in the 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 airtight containers and eaten as a snack or used in other recipes.

Dried pandanus flour

Pandanus flour is still made in Kiribati (but rarely) in the Marshall Islands and FSM 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 2 centimetres thick (called *te karababa*), placed in the sun for 2–3 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.

Recipes

Pandanus pudding

(*peru* from the Marshall Islands)

- Fresh ripe pandanus fruit
- Coconut cream
- Syrup prepared from sweet toddy or imported refined sugar

1. Boil pandanus keys
2. Scrape out the pulp (a special tool is available for this, see drawing on previous page)
3. Mix the pulp with coconut cream
4. Add 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

Pandanus paste in coconut cream

(*te roro* from Kiribati)

- Preserved pandanus paste *te tuae*
- Coconut cream

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 with taro

(*maitahlik* from Mwoakilloa Atoll, Pohnpei, FSM)

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

1. Boil pandanus keys
2. Scrape out the pulp
3. Add coconut cream
4. Add 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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